Compressed Air Magazine

Vol. 40, No. 6 London - New York - Paris June, 1935

EMPIRE STATE BUILDING NEW YORK, AS SEEN FROM A SUBWAY ENTRANCE

Diesel Electric Locomotives in the United States

1923

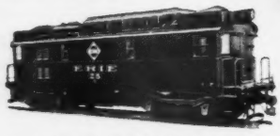
Original Demonstrator

1925

C.R.R. of N. J. 300 HP.

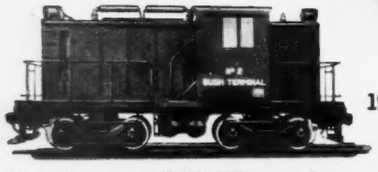
1927

Long Island 600 HP.



1929

Erie R.R. 800 HP.



1931

Bush Terminal 300 HP. steeple

1933

Lackawanna 600 HP. steeple

112 DIESEL LOCOMOTIVES IN SERVICE

The first successful Diesel engine for locomotive service in the U.S.A. was developed by the Ingersoll-Rand Company in 1923, and the first locomotive sold was to the Central R. R. of N. J. in 1925.

To date a total of 112 locomotives powered by Ingersoll-Rand Diesel engines have been sold. Each and every one of these locomotives is operating today.

It is the outstanding success of these locomotives in economy and reliability over a period of ten years of actual service that has made the Diesel-Electric locomotive a generally accepted type of railroad motive power.

As Originated and Developed by

1935

Ill. Central 1800 HP.

BIRMINGHAM
BOSTON
BUFFALO
BUTTE
CHICAGO
CLEVELAND
DALLAS
DENVER
DETROIT
DULUTH
EL PASO
KNOXVILLE

Ingersoll-Rand

11 BROADWAY, NEW YORK

LOS ANGELES
NEWARK
NEW ORLEANS
NEW YORK
PHILADELPHIA
PITTSBURGH
SALT LAKE CITY
SAN FRANCISCO
SCRANTON
SEATTLE
ST. LOUIS
WASHINGTON

Compressed Air Magazine

JUNE, 1935

Volume 40 Number 6

A Monthly Publication Devoted to the Many Fields of Endeavor in which Compressed Air Serves Useful Purposes

FOUNDED 1896

G. W. MORRISON
President

R. A. LUNDELL
Vice-President

F. E. KUTZ
Secretary-Treasurer

J. F. KENNEY
Business Manager

J. W. YOUNG
Advertising Manager

C. H. VIVIAN
Editor

A. M. HOFFMAN
Assistant Editor

European Correspondent
LINWOOD. H. GEYER
144 Leadenhall Street
LONDON, E. C. 4

Canadian Correspondent
F. A. McLEAN
620 Cathcart Street
MONTREAL

Business, Editorial and Publication Offices
PHILLIPSBURG, N. J.

Advertising Office
11 Broadway
NEW YORK CITY

EDITORIAL CONTENTS

Checking the Rampages of the Mississippi—R. G. Skerrett 4742
Thirty Years of Canadian Mining—Porcupine, Part I—R. C. Rowe 4746
Progress at Boulder Dam 4752
Curbing Damage to Foods and Tobacco by Insects—Allen S. Park 4754
New Portable Compressor for Track Work 4756
The Salvage of the "Bayern"—T. McKenzie 4757
Compressed Air Speeds Exposition Buildings—William E. Frazer 4761
Editorials—Engineers to the Fore—Concerning Streamlining—More Jobs for Collegians 4763
This and That 4764
Industrial Notes 4765

ADVERTISING INDEX

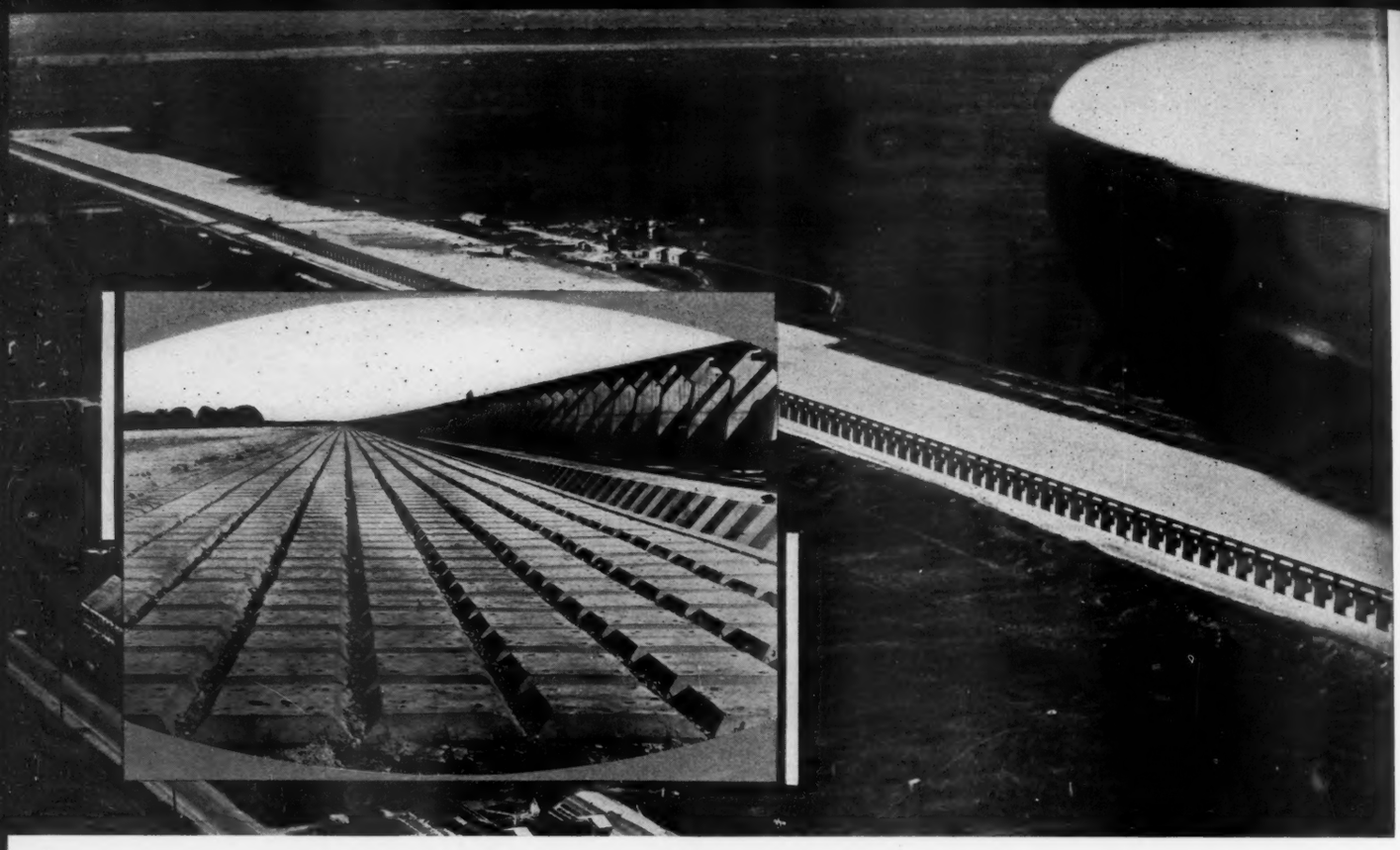
Allis-Chalmers Manufacturing Co. 9
American Air Filter Company 6
Austin-Western Road Machinery Co., The 28
Bethlehem Steel Company 5
Bucyrus-Erie Company 25
Bullard Company, E. D. 29
Combustion Engineering Co., Inc. 3
Dayton Rubber Manufacturing Co., The ..... Inside Back Cover
Direct Separator Co., Inc., The 14
General Electric Company 23
Goodrich Co., The B. F. 26
Hercules Powder Company, Inc. 4
Houghton & Co., E. F. 15
Ingersoll-Rand Company ..... Inside Front Cover-7-12-14-27
Jarecki Manufacturing Co. 14
New Jersey Meter Co. 29
Norgren Co., Inc., C. A. 29
Norton Company 16
Owens-Illinois Glass Company 19
Rotor Air Tool Company, The 21
Rockwood Manufacturing Co. ..... Insert between 21-22
Socony-Vacuum Oil Co., Inc. ..... Insert between 10-11
Staynew Filter Corporation 13
Texas Company, The 17-18
Timken Roller Bearing Co., The ..... Back Cover
United States Rubber Company 22
Waukesha Motor Co. 8
Westinghouse Electric & Mfg. Co. 11

Copyright, 1935, by Compressed Air Magazine Company. Save in special cases, permission to reprint articles, with proper credit, will be granted upon request to the editor.

Annual subscription rate: Domestic, $3.00; foreign, $3.50. Single copies, 35 cents.

Manuscripts intended for editorial consideration should be accompanied by return postage.

« « COMPRESSED AIR MAGAZINE is on file in many public libraries and is indexed in INDUSTRIAL ARTS INDEX » »



BONNET CARRÉ SPILLWAY

An airplane view of the structure, 38 miles upstream from New Orleans, which will make it possible in times of high flood to by-pass a great volume of water into Lake Pontchartrain and thence into the Gulf of Mexico. The inset shows a section of the reinforced-concrete mat that is designed to prevent the water passing over the spillway from exerting a scouring action. The 5.7-mile floodway extending to Lake Pontchartrain is being protected in this manner.

Checking the Rampages of the Mississippi

R. G. SKERRETT

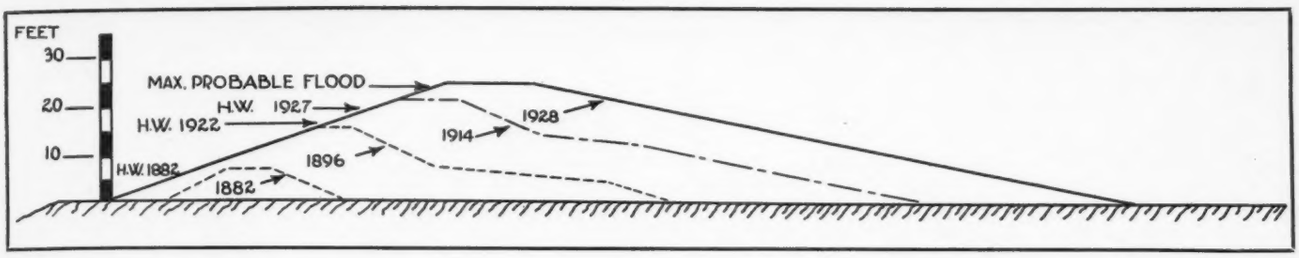
IN THESE days of gigantic engineering undertakings in this country, many of them well known because of sustained publicity, comparatively few of us are informed of the truly monumental work that is being done without parade to effectually control the Mississippi River when at flood stages. That project immediately concerns millions of our people within the region; and we all are more or less affected by the well-being and the prosperity of our fellows living there.

Eight years ago, the entire nation was appalled when the Mississippi mounted to an unprecedented height, overflowed or breached its flanking levees in many places, and inundated vast areas of the low-lying hinterland. That catastrophe caused direct and indirect losses which totaled more than $400,000,000, and occasioned widespread and grievous distress. In a sense, that disaster was the consequence of man's unheeding actions in stripping far-flung regions upstream of their stands of timber and modifying the country for his own purposes—thus increasing the measure of annual precipitation that could find its way quickly into the Mississippi and its tributaries. The violence of the flood of 1927 was also augmented by reason of the very levees that had been constructed to confine the river when in flood, because those barriers, by progressively reducing the width of the channel, forced the swollen waters to rise higher and to flow faster as they moved southward to the Gulf of Mexico.

The French founders of New Orleans built the first levee to protect that settlement from inundation early in the eighteenth century; and succeeding settlers in the valley added continually to that defense against the river in the course of the generations following. For the better part of 200 years the levees were reared at the expense of the states, counties, communities, and citizens directly benefited. The general Government assumed supervision in 1879 when the Mississippi River Commission was created. That organization of engineering experts sought primarily to standardize the forms of the levees seemingly best suited for the control of the river and to set about systematizing the whole problem of flood control and the regulation of the flow for purposes of navigation.

Three years after the commission was instituted, the Federal Government had charge of 991 miles along the flanks of the lower Mississippi—that part of the Father of Waters that traces its course for more than 1,000 miles between Cape Girardeau, Mo., and the Gulf of Mexico, an air-line distance of about 600 miles. In 1931, the levees within that region had a combined length in excess of 1,830 miles. Those earthen bulwarks have been designed and reared to protect 20,500 square miles of fertile and highly productive lowlands over which the river at flood stages was once free to ebb and flow in a relatively leisurely way on its journey to the Gulf of Mexico. Man has interfered with this manner of relief which the stream enjoyed for untold thousands of years. The flood of 1927 marked the climactic revolt of the Mississippi against cumulative trespasses upon its primordial rights.

In 1882, the standard sectional area of



GROWTH OF LEVEES

Since 1882 the standard sectional area of the main levees has been increased from 161 square feet to 3,173 square feet and the height from a maximum of approximately 7½ feet to anywhere from 20 to 30-odd feet. The dated flood levels indicated were registered at Lake Providence, Louisiana, and the assumed maximum level also refers to that location.

the main levees was 161 square feet, and the maximum height was about 7½ feet. As subsequent flood stages have reached higher levels, the sectional areas and the heights of the standard levees have been increased. Today, the levees range from 20 feet to more than 30 feet high, and major sections have an area of 3,173 square feet. In short, the main levees are believed to be massive enough and tall enough to overtop and to stand up against an assumed possible maximum flood somewhat greater than any recorded flood that has occurred in the valley since the first white man visited the region.

During the interval between 1882 and 1927, the flood level climbed as much as 12 feet at points in the lower river, while the difference between normal low stages and flood stages has been as much as 42 feet. The Mississippi and its tributaries drain an area of about 1,245,000 square miles, within which the average rainfall is something like 30 inches annually. The discharge into the Gulf of Mexico has been as high as 2,850,000 cubic feet a second; and the Corps of Engineers of the U. S. Army has estimated that the probable maximum flood will carry seaward quite 3,000,000 cubic feet a second! The magnitude of the problem of hemming in the lower river and of guiding its waters to the gulf should be self-evident.

The present plan of flood control no longer places entire dependence upon the main levees for directing the dangerously swollen waters of that great stream. Instead, the responsible experts identified with the work have, since the passage of the Flood Control Act in May of 1928, made concessions to the river. Henceforth, backwater areas and floodways will be available for its expansion in time of flood, and these avenues of relief will proportionately reduce the volume of water traveling onward toward the gulf between the main levees. Some of this detoured water will return to the normal course of the stream as a flood subsides, while the remainder of the inundating water will reach the gulf by other routes provided either by artificial spillways or by ancient waterways that are in process of improvement to facilitate this relief movement.

The total area of the alluvial valley, which lies between Cape Girardeau and the Gulf of Mexico, is about 30,000 square miles; and of this expanse approximately 20,500 square miles is to be protected—the remainder of the region is made up for the most part of unreclaimed swamp and timberland. The reclaimed portion is of great agricultural value. All told, 12,000,000 acres will be shielded by levees that will rise no less than a foot above the level of the highest probable flood. A total of 4,000,000 acres will lie within the lateral regions that will serve as occasional floodways, and another 4,000,000 acres will be intermittently covered with backwater. None of the flood waters will reach the lateral lowlands until the river has mounted to a menacing stage in the main leveed channel. A secondary line of lower and inner levees will limit the spread of the water admitted to the side basins, and the lands between the main and the secondary levees will be overflowed only during extraordinary floods, which have been found to occur at intervals of from ten to fifteen years. Generally speaking, the floodway and backwater lands will have protection equal to if not greater than that enjoyed by them up to 1927; and they will suffer comparatively little injury because the flood waters that may submerge them for a short while will not overflow them violently. Indeed, the deposited silt may enrich them.

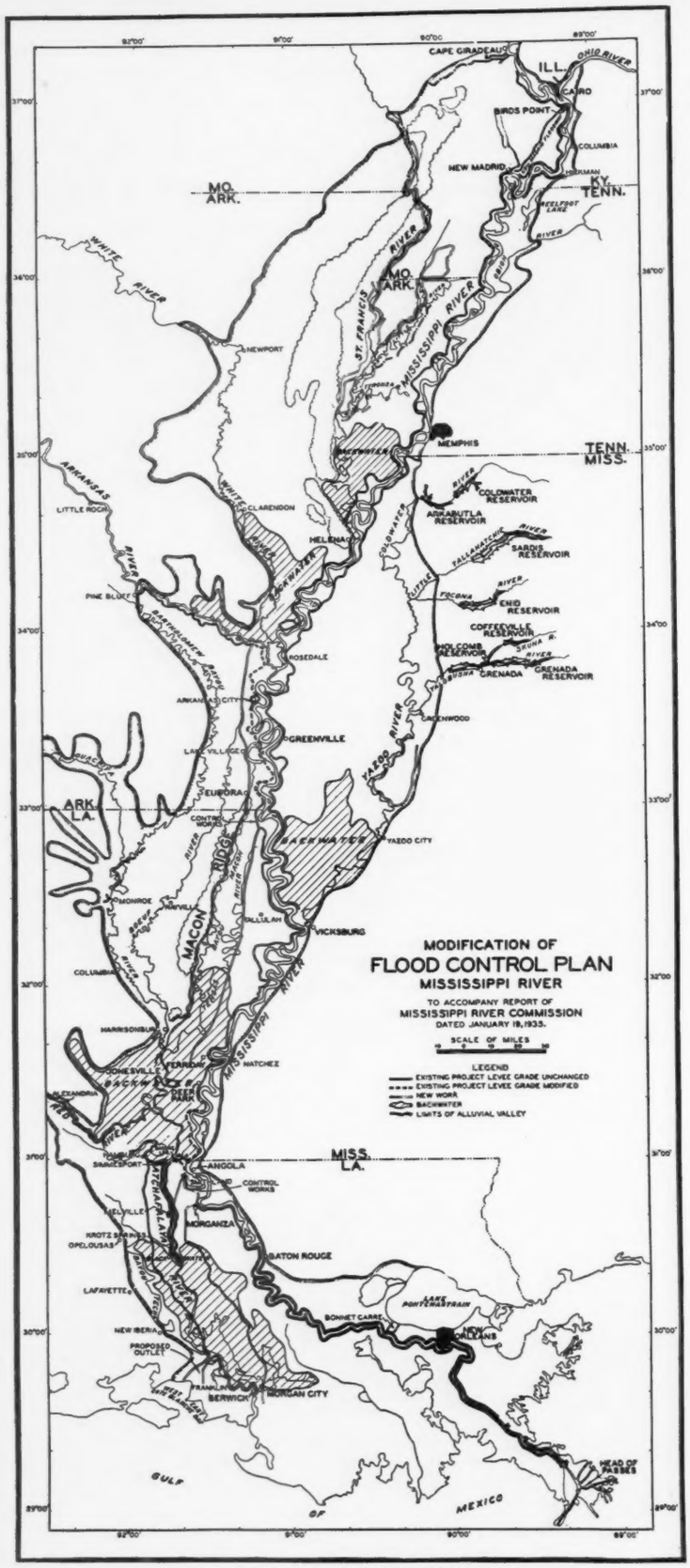
At strategic points provision is made for what are known as "fuse-plug" levees, which are embankments of the type and dimensions in use prior to the adoption of the present flood-control project in 1928. That project called for the raising of all existing levees about 3 feet, except throughout those stretches which were to function as fuse-plug levees and remain 3 feet lower than the enlarged and heightened levees. The fuse-plug sections are long enough to permit the passage over them of broad streams of water 2 feet deep when the adjoining levees are still 1 foot higher than the river's surface. In this manner the fuse plugs will facilitate the detouring of enough of the flood volume to relieve the river of excess water and to save the other levees from being overtopped by the torrent. The Chief of Engineers of the U. S. Army and the Mississippi River Commission have recommended to Congress that the United States pay the cost of land rights, up to 1½ times the assessed value of the land, within the areas to be used as floodways. For a decade or more after a submergence those fertile acres can be reworked profitably by their owners or tenant farmers.

The Atchafalaya River is to serve as a great floodway, and will lead a large volume of flood waters to the Gulf of Mexico by a subsidiary route; and 38 miles upstream from New Orleans has been constructed the Bonnet Carré Spillway that will permit some of the flood waters to escape eastward into Lake Pontchartrain and thence to the sea—thus assuring added security to that beautiful and historic city which is the Mississippi Valley's prime seaport. The Bonnet Carré Spillway is a masonry sill and a concrete structure supporting a movable needle dam that is 7,000 feet long. The needles are timbers 12 inches square and 8 feet or 10 feet in length. The needles hold the river at bay until they are lifted by mechanical means to permit water to

CONCRETE TETRAHEDRONS

One of the new revetments designed for Mississippi River flood control consists of precast blocks of concrete tetrahedrons. Their pyramidal shape causes them always to lie with one point upward. They can be placed by hand or dumped from barges. Each tetrahedron weighs 32 pounds and is 12 inches high. The plant shown is at Greenville, Miss., and can turn out 50,000 of the pyramids in 24 hours.

Photo, Simons-Mayrant Company



LOWER MISSISSIPPI BASIN

A recent map which shows the latest plan for flood-control measures. The backwater and floodway areas will permit a large volume of flood waters to spread laterally when the river reaches a certain fixed level. These relief features will keep the crests of the main levees at least a foot above the surface of the stream.

flow eastward to Lake Pontchartrain. Immediately below the spillway there is a stilling basin in which there are three lines of staggered, reinforced-concrete baffles that break up and reduce the flow of the water descending from the spillway. Between the stilling basin and the lake, 5.7 miles away, there is an articulated mat of concrete blocks that will prevent any scouring action of the stream. The spillway is of sufficient capacity to pass 250,000 cubic feet of water per second; and this relief should increase the margin of safety at New Orleans by lowering a flood crest by something like 2 feet.

Wherever feasible, the main levees are placed inland a safe distance from the immediate banks of the river and extended approximately parallel to the river channel. The earth utilized in constructing these bulwarks is obtained from borrow pits reasonably close to the sites of the levees. The pits are always shallow and far enough removed from the base of a levee to safeguard it from the undermining action of percolating ground water. As a rule, the location of the borrow pit necessitates a longer haul for materials than is usually the case where earth-moving machinery is employed, and for that reason special types of mechanical equipment are used for levee-building. Dragline derricks having exceptionally long booms do some of the excavating; at other points there are tower machines that operate buckets on cableways spanning many hundreds of feet between each pair of associate towers; and sometimes tractors drawing wagons filled by grading machines help in the rearing of levees. But no small part of the construction work has been done with the aid of hydraulic dredges that pump earth through extended pipe lines. As a consequence of the facilities developed for this field of service, earth has been moved on numerous occasions at a cost per cubic yard less than half that computed when the project was authorized. Up to date, there has been moved and placed on the protecting levees since 1928 a total of 523,000,000 cubic yards of earth. The entire project will involve the excavating of 650,000,000 cubic yards, or more than twice that handled in digging the Panama Canal!

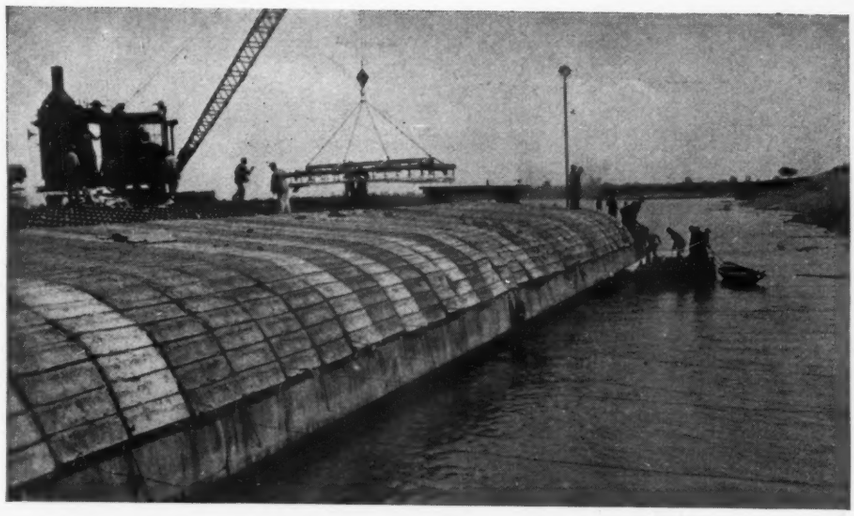
Where, because of property values or some other special circumstances, levees have to be built close to the shores, then measures have to be taken to fortify adjacent banks from undercutting by currents that might cause them to cave and bring about the collapse or weakening of the levees. At such places the banks, and even a considerable area of the contiguous river bed, are shielded from the scouring action of swift-moving and turbulent waters by means of suitable revetments that take the wear and tear of the currents. One of these consists of a flexible mattress that is laid upon the river bank from a point above low water and carried out on the water bed nearly to midstream. And it is not unusual also to pave the river bank from the low-water line upward for some distance. There are several kinds of underwater revetments. One, for example, is composed of a series of mattresses of willow fascines that are tied together with wire cable. They are not infrequently 200 feet wide and 1,000 feet long, and are sunk to the bottom and held there by rip-rap cast upon them from barges. Above the water line and the edge of such a revetment the bank may be graded and paved with a rip-rap of concrete. Another type laid on the bottom is made up of small reinforced concrete slabs tied together in both directions with steel or with noncorrosive wire. This mattress is flexible, the units being small enough so that the protective blanket can lie snugly on the irregular sides and bed of the stream. These mattresses are fashioned aboard floating mechanical plants.

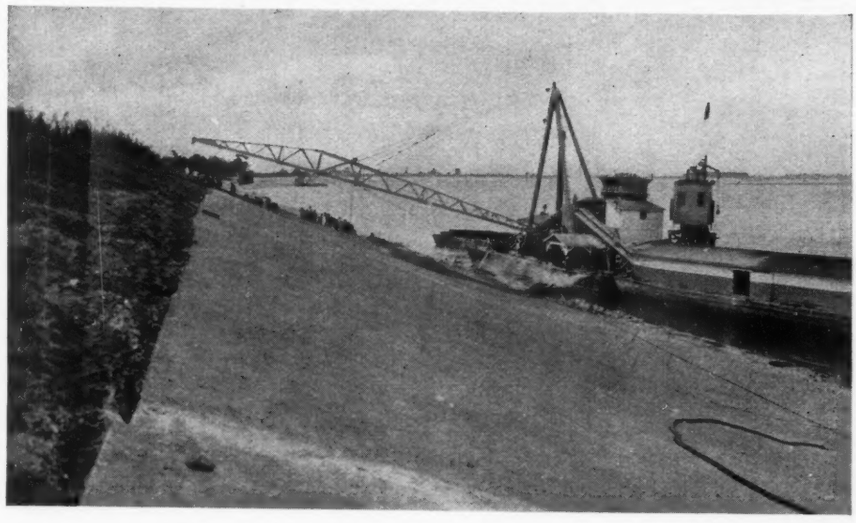
Recently, officers of the Corps of Engineers engaged on the lower Mississippi River project have developed two novel forms of revetments. One of these relies on the use of tetrahedron concrete blocks—angular pyramids that always come to repose with one point upstanding. Each tetrahedron weighs approximately 32 pounds and has a height of 12 inches. These blocks are preferable to rip-rap; and facilities have been devised that make it practicable to cast 50,000 of them in the course of 24 hours. The blocks can be arranged by hand on a bared river bank or can be dumped from barges to protect a submerged area. They can be made still more stable by spreading gravel upon them. One of their advantages, in addition to their moderate cost, is that they can be dropped in place in time of flood to meet an emergency calling for a quickly laid revetment.

The more unique of the two new types is the asphalt mattress that is manufactured and placed by a floating plant mechanically outfitted for the purpose. A mattress of this description, 2 or 3 inches thick and reinforced with wire cables and steel mesh, can be made in unit strips 30 feet wide and 217½ feet long. A succession of these strips, united without a break, can be turned out so as to form a single mattress 217½ feet wide and having a maximum length of 575 feet. Being flexible, the mattress can be launched and laid on a river bank and the water bed; and the areas so shielded are virtually covered with an asphalt pavement that may be counted upon to endure indefinitely. The mattress composition consists of 66 per cent river sand, 22 per cent very fine air-deposited soil, and 12 per cent binding asphalt. The loess is obtained from the bluffs along the river where it was precipitated in the dim past. Thus the bulk of the raw materials can be had conveniently and requires no processing other than drying to make it ready for use.

The flood-control project has so far called for the placing of more than 76 linear miles of revetments which will protect certain stretches of the river from erosion and the caving of the flanking banks. Navigation of the river will incidentally be helped. All told, 185,000 linear feet of dikes or low levees have been constructed under the present program which, when completed, will represent an outlay of about $325,000,000.

When the work is done, the industrial and the agricultural interests of the people within the alluvial valley will be far less imperiled than ever before by flood waters, and the steadily growing river traffic will be freer to move confidently at all stages of the stream. The magnitude of the task that is being mastered by the Corps of Engineers and the coöperating contractors is scarcely more than hinted in this article, which will, however, have served its purpose if it draw attention to what is being done to curb "Old Devil River."

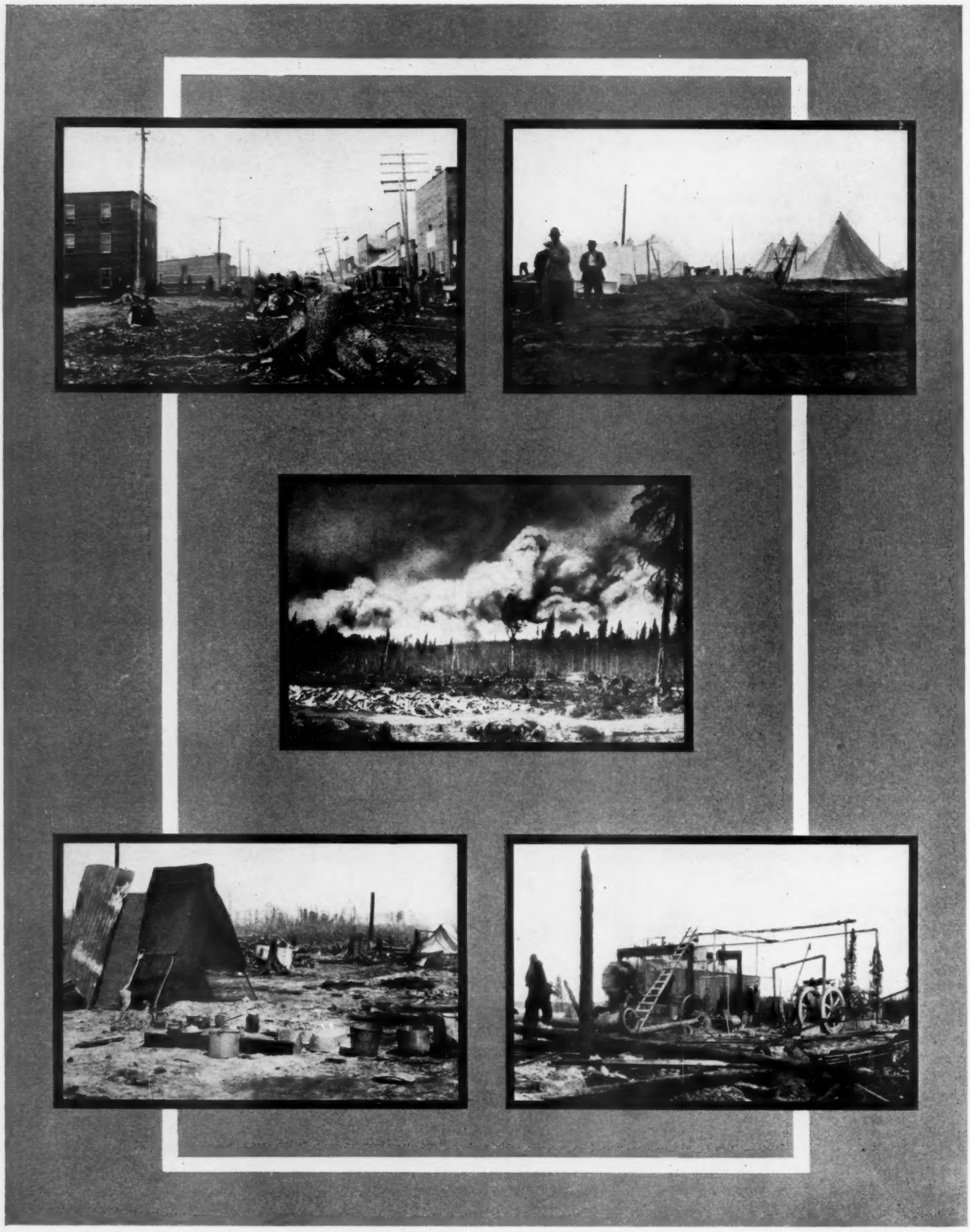




Photos from American Brass Company

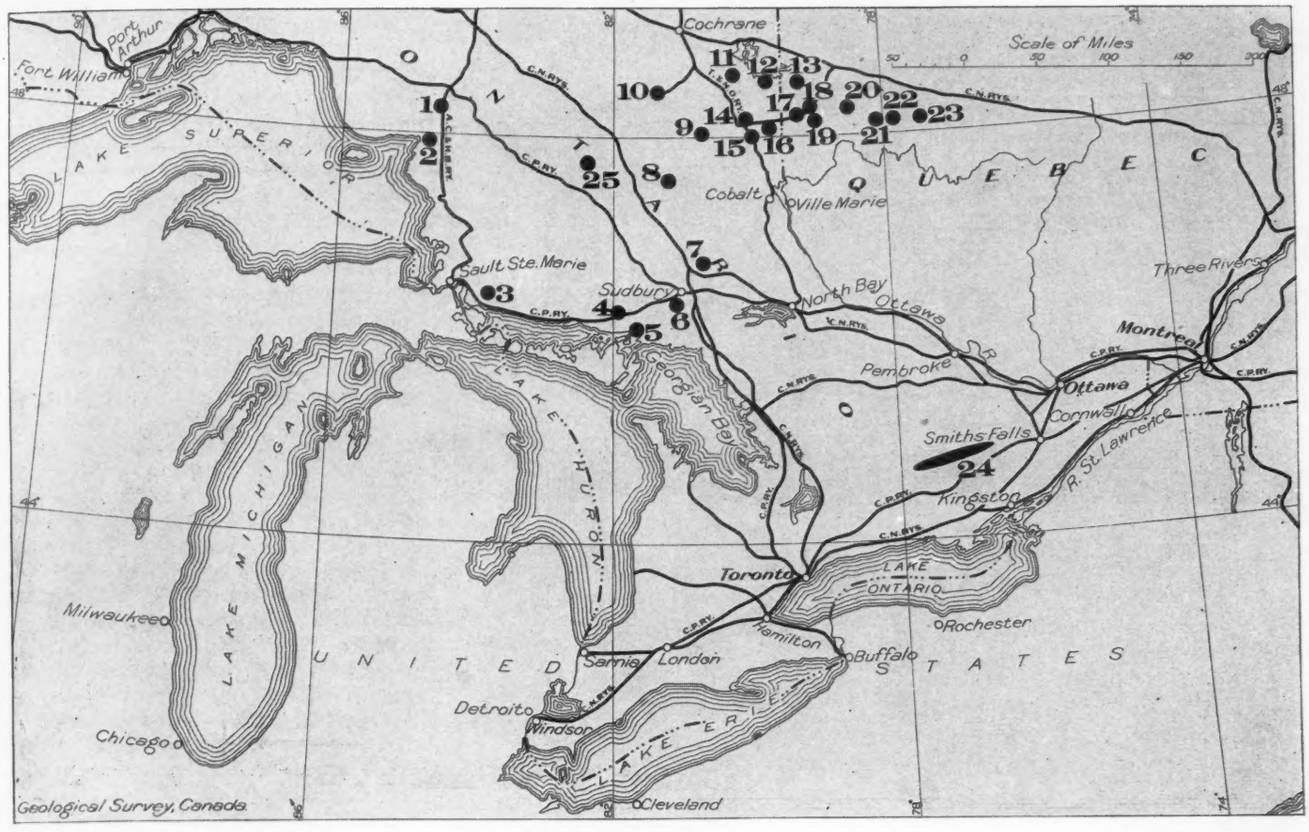
THREE TYPES OF REVETMENTS

Wherever the placing of levees close to the normal shore results in a somewhat constricted flood-time channel, the flanking banks must be protected from undercutting and washing by currents. Three of the various types of revetments are shown here. At the top a mattress, composed of concrete blocks tied both ways with noncorrosive Everdur metal, is being made ready for launching. In the center is a bank being paved with concrete. At the bottom is shown a new method by which an asphalt mattress is made aboard a floating plant and launched overboard.



THE STARK STORY OF THE FIRE

These pictures of Porcupine were taken in 1911, the year of the great disaster that cost 70 lives and leveled several towns. At the top is Golden Avenue as it appeared before and after the flames had swept everything before them. Fanned by the high wind, the fire traveled through the densely wooded district with terrifying speed (center) snuffing out lives and laying waste property within its grasp. At the bottom, left, are shown the rude shelters that were thrown up amid the charred ruins, and at the right is seen all that was left of the Dome Mine's steam plant—the remains of a Jenckes hoist and, to the right of it, an Ingersoll-Sergeant air compressor.



CANADA'S PRINCIPAL GOLD BELT

This index map of eastern Ontario and western Quebec shows the important known locations of gold in those areas. Their proximity to Cobalt indicates how logically their discovery followed the development of that famous camp. The map was prepared by the Geological Survey of Canada and was published in "Gold Occurrences of Canada" by H. C. Cooke and W. A. Johnston. The key to the numbers is as follows: 1—Goudreau, 2—Norwalk, 3—Havilah, 4—Shakespeare, 5—Howry Creek, 6—Long Lake, 7—Crystal, 8—West Shiningtree, 9—Matachewan, 10—Porcupine, 11—Munro, 12—Lightning River, 13—Beattie, 14—Kirkland Lake, 15—Boston Creek, 16—Larder Lake, 17—Arntfield, 18—Rouyn (copper-gold), 19—Granada, 20—O'Brien, 21—Malartic, 22—Siscoe, 23—Pascalis, and 24—Southern Ontario. Just above No. 6 is Sudbury, the world's greatest source of nickel.

Thirty Years of Canadian Mining

Porcupine—Part 1

R. C. ROWE

I

Which Tells How It Was Found

"'Send your road is clear before you when
the old Spring-fret comes o'er you,
And the Red Gods call for you!"
—KIPLING.

THE next important event in the cavalcade of progress we are reviewing was the discovery of Porcupine which, like Cobalt, set all the world atwitter and which, unlike Cobalt, is still in the full glory of its strength.

The Porcupine District lies roughly about 100 miles northwest of Cobalt. The area is generally flat, and in the early days was heavily wooded. It is a country of low-lying land and shallow lakes, and the rock outcrops rarely rise much over 50 feet above the surrounding country. Previous to the actual finding of gold, the district had been referred to by various government explorers as a promising region for the prospector. In 1896, E. M. Burwash noted quartz veins, and W. A. Parks, in his 1899 report, remarked: "I regard the region south of the trail to Porcupine Lake as giving promise of reward to the prospector."

These minor matters are important because there is one great basic difference between the discovery of Cobalt and the later discoveries in northern Ontario. The finding of Cobalt was an accident. No one was looking for silver. A train of circumstances brought men and those silver-bearing veins together—that was all. But the discovery of the great gold fields of Ontario was the result of organized search. It is true that some outcrops were come upon by chance; but in all cases the men who were in the country were there with the definite object of finding minerals. They were prospectors, and there was nothing accidental in the fact that they got what they were after. It is this basic difference which makes those early reports so important, because there is no doubt that it was partly the observations of those exploring government geologists that turned the attention of the gold seekers to that flat-lying, fly-ridden, and rather uninviting country.

In a preceding chapter we have mentioned the fact that the silver discoveries of Cobalt resulted in a rush that drew men from all parts of Canada and the world. Among these were many experienced prospectors and men of the pioneer type who, following their natural bent, moved out

Geological Survey of Canada

THE GREAT QUARTZ DOME

The discovery by J. S. Wilson in 1909 of massive hummocks of quartz with streaks of gold ore running through them precipitated a great rush of humanity to the Porcupine area. Upon their site rose the Dome Mine, which has since produced more than $60,000,000 in gold. At the top is seen a portion of the "Big Dome" where a 4-foot gold vein traversed it. For a time the deposit was worked by the glory-hole method, as shown below.

from the crowded and staked areas of Cobalt. They spread along all waterways and routes of travel, and we have seen how they drifted down into South Lorrain and up to Elk Lake and Gowganda in quest of silver-producing areas tributary to Cobalt.

Those were kaleidoscopic days. Lured on by an indefinite promise, and driven by the urge of their own spirit, men were traveling the streams and lakes of the North, being burned black by wind and sun, braving flies, and enduring hardships. As one looks back today, one gathers an impression of ordered fate about these matters. There seems to have been something inevitable and irresistible about that northward movement of men that reminds one in some vague way of the drift of tides. In their journeyings they came close to the Quebec boundary where they found gold at Larder Lake, which name, by the way, is a literal translation of the original Indian. They also traveled northward along the route of the Temiskaming & Northern Ontario Railway; and in consequence the Lucky Cross Mine at Swastika was staked in 1905. This created a small flurry; but the adventurers continued to press north.

There is no absolute certainty as to the exact date when the first of the gold seekers wandered into the Porcupine District. It is known definitely that one R. B. Daigle dug a small pit on the very property which later became the Hollinger gold mine. It is thought that this occurred about 1906, which would correspond roughly with the progress of the northward movement. The fact that Daigle's pit was overgrown with weeds and weathered when found again in 1909 by Benny Hollinger would also tend to place the year of this first work there about 1906.

In any case, this early history is rather clouded: it is difficult to pick out the exact truth because the stories concerning it differ in many respects. It is said that the first gold from Porcupine was brought out by two trappers, Geddes and Lemon, in 1908. The tale goes that they showed their samples around Haileybury; but as they were definitely "looking upon the wine when it was red," and as their versions of the discovery probably varied as to detail and locality with the degree of their exuberance, most people put it down as a figment of the imagination. In the end, however, they did succeed in interesting an Englishman who, in turn, obtained a grubstake for them from a Mr. A. G. Hunter.

This expedition was not successful. So far as can be determined, dissension developed among the members of the party on its trip north. This was not surprising, as fate had thrown together three men whose philosophies and outlooks upon life had no common meeting ground; and many a wilderness tragedy has sprung from that very thing. But in this instance there was no tragedy, except that of wasted effort, for the differences of opinion grew to a point where the two trappers suffered from convenient lapses of memory which prevented them from finding the spot whence their samples had originated. The Englishman, however, being very much alive to his obligations, staked claims for his principal on the east side of Porcupine Lake. Those claims seem to have been the first recorded in the area. That was in 1908.

In 1909 came the great news of the Porcupine discoveries; but even in their case it is hard to arrive at a proper sequence of events. In some ways this really is of little consequence, for there were at least two independent parties in the field, and the matter boils itself down to the simple question of precedence. While that knowledge might be interesting, it is of no great moment, because J. S. Wilson found those great hummocks of gold-seamed quartz which were popularly known as "The Dome." They riveted the attention of the world upon the district, and later became the famous Dome Mine.

There is a story, and probably a true one, that George Bannerman was the first to reach the district in 1909, having been enticed there from the ice wagon he was driving in Haileybury by the two trappers who drifted into the town with more samples and a great thirst. The claims that Bannerman staked were some distance from Porcupine Lake, and subsequently became the Scottish Ontario.

It was Wilson's discovery that started the rush to Porcupine. The great dome of quartz, with its load of visible gold, was a startling spectacle in that flat-lying, tree-clad country, and the old-timers who saw it in the early days still speak of it with bated breath and a far-away look in their eyes. In its way it was even more striking than the veins at Cobalt with their load of native silver, for there is something about the sight of gold in large quantities that stirs an age-old emotion in men and

quickens the pulse in their bodies—the precious metal has so long been their symbol of wealth and power.

As we grope among the stories, it is difficult to arrive at any continuity; but we gather that Wright and Bannerman returned to Haileybury to record their claims and to spread the news of the discoveries. Their appearance and their samples created much excitement, and the gold fever attacked all manner of men. A hurried but surreptitious movement northward began; but, more important still, the news of the strike began to travel via the "moccasin telegraph" to many parts of the North and to attract men whose names were to become famous.

Fate stages its little dramas around casual things, and there could be nothing more casual than an unknown person telling a story about gold at Porcupine Lake to a man working in the vicinity of Gowganda in 1909. That conversation started a train of circumstances that was to have far-reaching effects. The man who listened to the story was none other than Sandy McIntyre, who was destined to give his name to a great mine. The tale probably recounted with incredible embellishments, fired his imagination for the reason that he was imaginative; but, in all likelihood, the fact that he had been grubbing around Gowganda without very tangible results had something to do with the matter. Anyhow, whatever it was, Sandy McIntyre hurried to Haileybury. That in itself was important, but apparently fate had decreed that this Scotsman, an ironmolder by trade, should have more than a mere finger in the drama of Porcupine, for almost the first person he met in Haileybury was Benny Hollinger, who also was to have a famous mine named after him.

Benny was twenty-four. After prospecting for some time with Alex Gillies, who will figure prominently in other parts of this history, he had become somewhat disgusted, and was giving careful consideration to the prosaic but eminently practical idea of returning to his regular work. He was a drill sharpener, and drill-sharpening looked infinitely more profitable than prospecting the particular morning he met Sandy McIntyre. Upon such chance meetings do the courses of life and fortune depend, for Benny Hollinger turned from drill-sharpening to riches and to such immortality as a great mine carrying his name can give him.

Sandy McIntyre told Hollinger of the northern discoveries, with the result that he and his partner Gillies started north in their canoe. They landed in Porcupine on October 1, 1909, only to learn that most of the ground around the lake in the vicinity of the Dome had been taken up. Being true prospectors, they were not content to stake on the fringes of likely country, and moved on. They gathered a light pack and, following the old Indian trail, traveled west until they reached

EVOLUTION OF THE HOLLINGER

Benny Hollinger was disgusted with prospecting and about to return to his trade of drill-sharpening when Sandy McIntyre told him in Haileybury, in 1909, of important gold discoveries farther north. Hollinger and his partner, Alex Gillies, left at once for the promised land. Thus began the Hollinger Mine, which has since yielded some $200,000,000 worth of the precious metal. These pictures show its early growth, and were taken in 1910 and in 1913.

Pearl Lake, where the rock conditions caught their fancy. On the third or the fourth of that month they struck gold, and it was Benny Hollinger who found it—a large chunk of free gold. That was the beginning of the Hollinger Mine which had produced $194,397,076.64 worth of the precious metal up to the end of 1933. While prospecting their claims they discovered Daigle's pit; and how close he had come to fortune was evidenced by the fact that outcropping gold was plainly visible within 20 feet of it.

Meanwhile Sandy McIntyre was having his own troubles. His partner on the expedition was Barney McEnaney; but Barney developed rheumatism so badly that he was unable to go. It was while McEnaney was sick that Hollinger and Gillies left; and this little matter is mentioned because it serves to emphasize the broad loyalty of those pioneers. When Hollinger had finished staking his claims he remembered McEnaney, who would have been there but for his illness, and staked one for him. That claim later became the Porcupine Crown, a subsidiary of the Crown Reserve of Cobalt. The deal between McEnaney and the Crown Reserve was arranged by John E. Hammell, whom we have already observed at Cobalt and who at that time was well started on his meteoric career in mining.

Returning to Sandy McIntyre, we find that he eventually got away with a partner who knew nothing about prospecting and even less about bush traveling. His name was Hans Buttner, and he was a cook. On the way in—at Jack Pine Point on Frederickhouse Lake, to be exact—they met Benny Hollinger coming out to record his claims. Hollinger showed them his samples, which McIntyre later picturesquely described as "being plastered with gold,"

and told them all about conditions and locations. It is a fact that Sandy McIntyre, even with a partner who knew less about canoes than he did about aeroplanes—which is saying a lot about those early days—made a record trip into Porcupine.

The first claims staked by this oddly assorted pair were two for Buttner; and on the next day McIntyre staked two for himself. That night their tent caught fire and they were left without camping facilities with the season creeping on. They therefore had to leave without doing any more staking, and by the time McIntyre returned, all the ground had been taken up, which was hard luck. While these events were transpiring, Bill Davidson was staking the claims which afterwards became the Vipond, and Ollie McNeil was planting stakes on what became known as the Pearl Lake Gold Mines, which was eventually absorbed by the McIntyre-Porcupine. The trails to the North were being choked with men on their way to the new gold fields, and before Christmas, 1909, the country was staked for miles.

Meanwhile, with the approach of winter, Hollinger and his associates had erected the first building on the Hollinger property. It was a log cabin measuring somewhere about 12x16 feet, and it became the rendezvous of the district, acquiring thereby a certain fame as a meeting place for prospectors. This writer has talked with a man who stayed there for a while and who still sees in his mind the picture of that warm and pleasantly stuffy interior, with the lighted lantern seen through a haze of tobacco smoke. Many a tall tale and a brave plan was told and made there, and some of those who sat there have traveled far, and some are dead, for that is in the inevitable order of the march of time.

But looking back on the interior of that first building on the Hollinger, we get an impression of immense time. It is almost as though we were looking back on another age. Yet it is only a matter of 25 years—just a quarter of a century—since the possibilities of the great Hollinger Mine were still unknown. So much has happened in the interval. Porcupine has taken its place as one of the great gold fields of the world; it has poured millions of wealth into the economic coffers of Canada; and it has contributed mightily to the technical progress of mining. Twenty-five years ago was still nearly five years before the great war which seemed to alter the world and the whole of life, and usher in a new age. No wonder it seems so long ago. Thus passed the winter of 1909, and finally came the spring of 1910.

II

Which Briefly Outlines Its Development

"How many thousand men had done his will,
Men who had hands, or arms, or strength to spend,
Or cunning with machines, or art, or skill,
All had obeyed him, working to this end."
—MASEFIELD.

THE year 1910 was an outstanding one for Porcupine. In the first place the great rush struck its full stride. Claims were being worked in all directions, and there was a fever of activity. This was important, but not so important as might have been expected, which brings us to a brief consideration of one of the features of Porcupine. There are several of them, but the one we are referring to at this point is that all the properties which eventually became established producers in the district were initial discoveries. The Dome, the Hollinger, the McIntyre, the Vipond, the Newray (which later became part of Coniaurum) were the earliest stakings in the area. In the years that followed, many millions of dollars were expended in trenching, diamond drilling, sinking, and underground work; but nothing comparable to the [illegible] y major discoveries ever materi[illegible]

During 1910 several [illegible]nts transpired upon which the future solidity of the camp was based. The first of these was the entry of the Timmins-McMartin-Dunlop Syndicate into the field. These men had already become famous in the development of the Cobalt camp. They had been pioneers in the great silver-mining district, and they were pioneers in Porcupine as well. They acquired the claims of Benny Hollinger, Alex Gillies, and Jack Miller, a total of ten in all. Work was immediately begun on surface showings that were singularly spectacular. Later in the year Hollinger Gold Mines, Limited, was incorporated to take over the claims of Benny Hollinger, and the syndicate held a majority interest in the company.

Also during 1910, Dome Mines Company, Limited, acquired the original Dome claims and started active development. Porcupine Gold Mines Company, the forerunner of the present Vipond Consolidated Mines, Limited, did likewise. Many other companies were formed, and a great deal of work, including underground operations at a number of properties, was carried out during the year. A 2-stamp Tremaine mill was actually put in service on the Hollinger. All this was remarkable when the conditions facing the early operators are borne in mind.

In the first place, the new gold field was quite without transportation facilities. The nearest railway station was at Kelso on the Temiskaming & Northern Ontario Railway. The course followed in the summer was from Kelso to Frederickhouse Lake by road, and from the landing on Frederickhouse Lake supplies were taken by gasoline launches and light scows to Porcupine Lake via Frederickhouse River, Night Hawk Lake, and Porcupine River. The roadway from Kelso to Frederickhouse Lake was particularly bad, and so were the portage roads on the water route. In the wintertime, however, they were excellent, and, as was to be expected, there was a tremendous movement of materials into the new camp during the winter of 1910.

It is probable that the development of the North has seen nothing more picturesque than the spectacle which the road to Porcupine offered that winter. That was still the day of the horse. The stopping places were redolent with the smell of horse and the tang of wet leather, and they were noisy with the cursing of teamsters

IN THE VANGUARD

Close behind the prospector and the miner went various business interests to render essential services to the frontier settlements. The ornateness that traditionally characterizes bank structures is conspicuously lacking in the rude log home of the Imperial Bank of Canada that graced Porcupine in the early days; but it served its purpose well, and vast sums of money and gold bullion passed through its portals while the camp was in its lush days.

and the jingle of trace chains. That was a period of strenuous and prodigious accomplishment and men spoke with bated breath of the load taken in by some team or other, and of the fine points of horses; but, all the same, it was a hard situation for men and animals, for there was money in freight if it could be moved fast, and so . . . fast it moved. Men with droning tractors now perform transportation feats that make those achievements look like nothing; but, in spite of that, there was something fine about it all that leaves the world just a little poorer for its passing. The railway entered the district in 1911, and thereafter the transportation problem was solved.

The year 1910 passed with the usual fever attending a new camp. Optimism overflowed, and rumors ran rampant. There was the usual amount of froth and wasted effort, with its consequent disillusionment: there was the usual skepticism and the inevitable argument as to the ultimate value of the new camp. But through it all, the systematic work on the major discoveries went on. This proceeded so encouragingly that two of the companies, the Hollinger and the Dome, decided to install stamp mills, and the equipment for these was hauled in during the winter of 1910.

The following year broke optimistically, so optimistically in fact that more than half a dozen town sites were laid out, and building went ahead quickly. Stores, hotels, eating places, and residences sprang up as though by magic. Hollinger was busy with the construction of a 30 stamp mill, while Dome was engaged in the erection of a 40 stamp plant. It looked as though the new camp were headed for prosperity without a setback; but disaster was casting its shadow over the whole country.

To understand clearly the nature of the catastrophe that struck the district, it is necessary to form a picture of the general conditions surrounding Porcupine. We have already pointed out that the country was low lying and heavily timbered. Here and there were small clearings in which men were pursuing their little activities, while all through the woods other men were engaged in prospecting or were intent upon various errands. Most of them were experienced bushmen, but some of them were not, and in a dry season the situation reeked of all the possibilities that a carelessly made fire or a casually thrown match might open up. The spring and early summer of 1911 were dry, and the woods became like tinder, with the result that bush fires broke out in several places. As often happens in such cases, most of these were local affairs that did not appear very dangerous; but in May a local fire swept down on the Hollinger and completely destroyed all surface workings, including the new stamp mill. But there was no loss of life.

During the remainder of May and on into June the weather continued hot and dry, and the number of isolated bush fires in the district increased. Then, on July 11, came the holocaust that startled the whole of Canada. On the morning of that day a soft southwest wind was blowing, but at noon it developed suddenly into a gale of hurricane velocity. Almost immediately smouldering ground fires were whipped into flames which worked into the tops of the evergreen timber. Only those that have seen a bush fire traveling in the "tops" in front of a high wind can have any conception of what it means. It is difficult to imagine anything more terrifying or more devastating; and this was the spectacle that met the inhabitants of such towns as South Porcupine, Pottsville, and Golden City, and the working crews of mines shortly after noon on July 11.

Men in the communities and mines stuck to their posts in a futile endeavor to check the flames, and many of them stayed too long and died there. The billows of black smoke from the burning tops obscured the sun, and there is no doubt that many a man racing toward water and safety through the bush was overcome by the smoke and fell in the path of the onrushing flames. The inhabitants of the towns made for Porcupine Lake, the surface of which had been whipped into heavy seas by the high wind. Fortunately, like all the lakes in the country, Porcupine Lake was shallow, and the people could wade out of reach of the raging flames, but the conditions were such as to strike terror into the hearts of women and children.

The lake was canopied with a curtain of black smoke which was streaked here and there with livid streamers of flame, while the surface of the waters was churned up with waves that were remarkably high for so small a lake. As a consequence, seven men were drowned through the capsizing of canoes. So far as possible, women and children were taken into boats during the height of the fire, which worked its way around the lake to Pottsville, which was entirely laid waste, and approached Golden City. Had the latter—which was the only remaining place of shelter for the people of South Porcupine and Pottsville—been destroyed, the situation of those rendered homeless would have been still more tragic; but by strenuous efforts a large part of Golden City was saved, and a refuge for the destitute and stricken was assured. As the afternoon wore on, and it was seen that Golden City was spared, the work of caring for the needy began, and the Porcupine District commenced to take stock of the disaster that had descended upon it.

It was a heart-rending story that came out of that smoke-blackened country. It was heavy with tragedy, but alive with the heroism that men show in the face of a crisis. The fire claimed about 70 lives, and did tremendous damage to the surface plants of the mines which, in many cases, were completely wiped out. At West Dome Mines, R. A. Weiss, manager, and his wife and daughter, together with seventeen others, sought refuge in the shaft when cut off by the flames, and perished through suffocation. Four or five men died in and around the surface plant. At the Dome Mine the entire surface plant, including the new stamp mill, was destroyed, and the toll was twelve men. At the various mines men died because they refused to leave their posts, and stayed until too late in a futile attempt to save the property entrusted to them. Searching parties brought in the pitiable remains of those that were trapped in the woods and who had lost the race for safety.

This is the third of a series of articles by Mr. Rowe. The fourth will be published in our July issue.

AMONG THE PIONEERS

More important even than money to a new mining camp is machinery. Digging ore from the bowels of the earth is hard work at the best, and without mechanical aids it calls for back-breaking labor and is also inordinately expensive. Compressors and drills are among the first wants, and to supply them salesmen follow the newly blazed trails wherever they may lead. Shown here is the office of an equipment manufacturer in South Porcupine about 1913.

Fairchild Aerial Surveys, Inc.

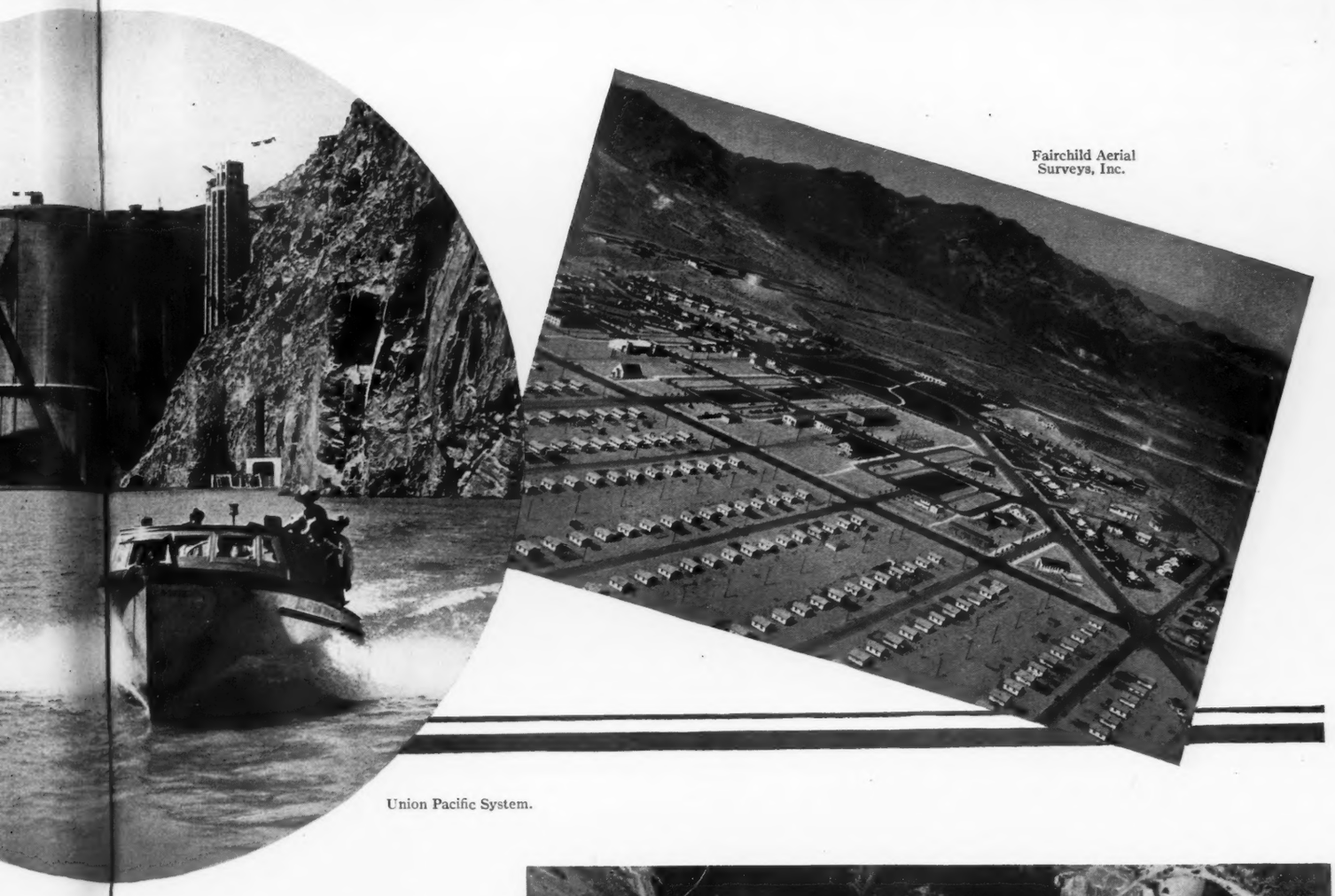
Fairchild Aerial Surveys, Inc.

Progress at

ALTHOUGH a number of months will elapse before the power-generating equipment at Boulder Dam is ready to function, the dam itself is nearing completion, as some of these pictures clearly reveal.

Since the impounding of water began last February the reservoir has been taking form, slowly at first and more rapidly in recent weeks as the volume of the Colorado River has been swollen by spring rains and the increased melting of accumulated snow in the high Rockies, where the stream has its origin.

On May 15, the lake behind the dam was 44 miles long and had a maximum depth of 122 feet. The shore line was at elevation 773, or approximately 450 feet below the ultimate high-water level. A variable volume of water, in excess of 5,000 second-feet, is being released through the outlet works of the dam to supply downstream requirements.



Fairchild Aerial Surveys, Inc.

Union Pacific System.

s at Boulder Dam

The picture immediately above shows a power boat in front of the dam. The reservoir already is giving promise of becoming a sportsman's oasis in the desert, and is also being put to use as a landing area for amphibian airplanes.

The view at the upper left illustrates the bleakness of the country where the dam is located and the reservoir as it is beginning to form. The huge concrete barrier is almost lost to the eye in the great expanse of territory pictured.

At the upper right Boulder City spreads out in symmetrical form. The permanent part of the city is in the background, while the workmen's homes, in the foreground, are temporary. At either side are aerial pictures of the final stages of the work at the dam. The one at the left was taken from above the Arizona canyon rim. The other is a view looking upstream from the Nevada side of the river.

Fairchild Aerial Surveys, Inc.

Curbing Damage to Foods and Tobacco by Insects

ALLEN S. PARK

TWIN TREATMENT CHAMBERS
The truck is loaded with Turkish tobacco destined for blending into Lucky Strike cigarettes. Each of the two chambers shown is 58 inches wide, 78 inches high, and 37 feet long.

MANUFACTURERS of many food and tobacco products are confronted with a problem which is quite unknown to most users of those commodities. That is the insect menace. The U. S. Department of Agriculture estimates that the loss incurred annually from insect attack upon stored foods approximates the staggering sum of $1,000,000,000. This total does not include the damage done to tobacco products, which are as subject to their ravages as are foodstuffs. The destruction which is thus wrought by insect life exceeds the fire losses in the same classes of goods by a considerable margin.

The problem is complicated by the fact that products which are apparently free from infestation when they leave the factories may be affected when they reach the consumer. This can happen as a result of the intermediate hatching of insects from eggs which were virtually invisible at the time the goods were inspected at the manufacturing plant. The consumer who is unfortunate enough to receive such a product immediately envisions an insanitary and carelessly run factory, and resolves never again to purchase anything bearing that trademark. In addition, he generally tells others of his experience, and they form similar opinions. Thus, the indirect and unknown loss suffered by manufacturers through refusal of patronage probably far surpasses the tangible loss sustained through the destruction of stored goods.

Foodstuffs of different kinds are subject to infestation by weevils, beetles, moths, mites, and other forms of insect life. Those oftenest affected are beans, peas, crackers, cheese, candies, dried fruits, cereals, nuts, and macaroni. In most cases, several varieties of insects may infest a product; and, in the majority of instances, the eggs are deposited while it is in the raw-material state—that is, before it arrives at the plant where it is processed and packaged.

It has long been recognized that fumigation at one or more stages during the handling of these products is required to insure an absence of insect life when the goods reach the market. But formerly there were objections to fumigation. Effective treatment often called for the use of substances which were undesirable because they were flammable, explosive, poisonous to human beings, or so expensive in themselves or in their application as to make them uneconomical.

Within the past few years, however, fumigants have been introduced that overcome these objections. Coincidentally, the technique and equipment of fumigation have undergone improvements, with the result that establishments that process goods subject to insect infestation now are able positively to eradicate this evil and to do so at a moderate cost.

Among the new fumigants is one which goes by the name of Guardite. It is a mixture of one part ethylene oxide and nine parts carbon dioxide. Ethylene oxide, which is the basic insect-destroying agent in the compound, was first developed by Drs. R. C. Roark and R. T. Cotton of the U. S. Department of Agriculture. In the proportion mentioned, it is highly poisonous to all species of insects that attack food and tobacco products. Since concentrations considerably less than those required to kill larvae or fully developed insects suffice to kill eggs, observation of its success against the advanced forms constitutes proof that the fumigant also destroys any eggs that may be present, even though they are too small to be readily visible. Despite its deadly effect upon insects, Guardite is relatively nontoxic to persons, and can be handled without danger. It is likewise nonflammable and nonexplosive, and is approved by insurance underwriters' laboratories. The gas possesses the further advantage of being harmless to the products treated. It leaves no evidence of its use, and does not affect the color, odor, or taste of foodstuffs or tobacco.

The fumigating can be done either under atmospheric pressure or in a vacuum, but the latter method possesses such decided advantages that it is generally adopted whenever conditions will permit it. The four important factors upon which success is contingent are the nature of the product, the concentration of the fumigant in the treatment space, the temperature, and the time of exposure. Temperature is of lesser importance where the vacuum method is used; and, because of the close control that can be exercised, the time of exposure can be shortened. For various classes of goods, the duration of that treatment ranges from one to four hours. The concentration—that is, the volume of gas required to assure effectiveness, has been determined for individual products by experience.

Research has shown that the effectiveness of a fumigant rises as the rate of respiratory metabolism of the insects increases. The respiratory function can be quickened by raising the temperature, increasing the carbon-dioxide content of the fumigating chamber, and decreasing the oxygen content of the chamber. Because the last-mentioned factor is more important than the two others, the employment of vacuum-chamber fumigation is desirable. When a vacuum corresponding to 29 inches of mercury is induced in the chamber, the oxygen content of the air is reduced from a normal proportion of 21 per cent to .007 per cent. This greatly augments the respiratory action of the insects, thereby

rendering them much more susceptible to the toxic effects of the gas and cutting down the dosage needed to insure a 100 per cent killing. The desired increase in the carbon-dioxide content of the fumigating chamber is, of course, accomplished through the introduction of the Guardite.

Special equipment is provided for the Guardite vacuum process, the nature and the size of the principal elements being varied according to the specific use to which the unit is to be put. The treatment chamber is a welded-steel vessel, with counterbalanced doors at one or both ends. It may be cylindrical, square, or rectangular in section to meet the requirements of the materials to be fumigated and to facilitate handling them in and out of the chamber. Chambers are in service that will accommodate five barrels of nutmeats, and others big enough to receive the contents of two standard railroad box cars at a time.

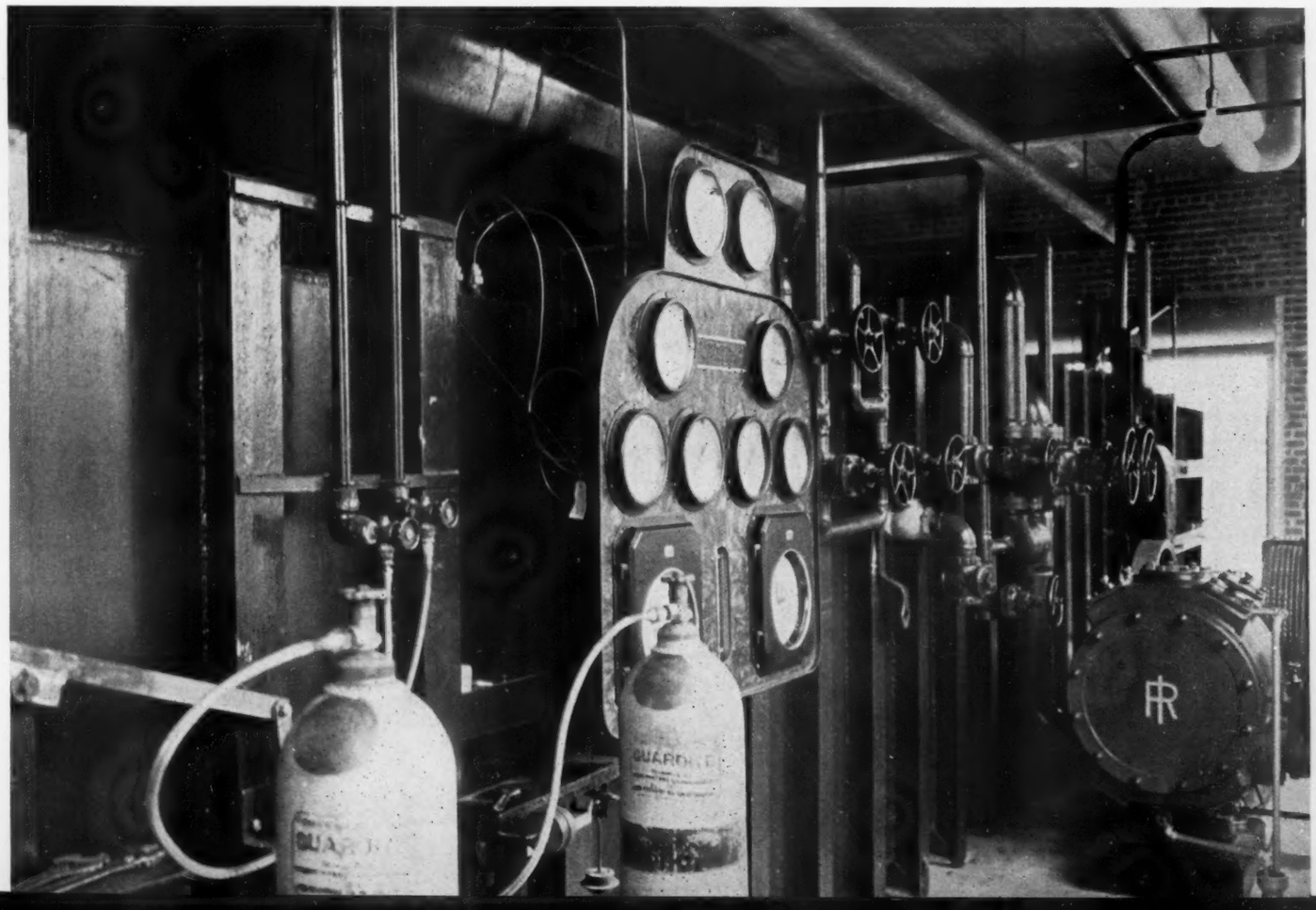
A dependable motor-driven vacuum pump is an integral part of each unit, the type of pump depending somewhat upon the size of the chamber to be exhausted. For large chambers, 2-stage reciprocating units, such as the one pictured, are employed. The Guardite gas is delivered in cylinders which contain 60 pounds of the ethylene oxide-carbon dioxide mixture under a pressure of 880 pounds to the square inch. To insure thorough mixing of the gaseous elements, and to provide a means of heating the fumigant before it is applied, an accumulator is included. It is equipped with heating coils and connected to the treatment chamber so that the two vessels may be exhausted simultaneously. All phases of the operations are indicated on gauges on an instrument panel. In addition to pressure, vacuum, and temperature gauges, there is a recording chart which shows exactly what conditions obtain in the chamber throughout the day, thus making available a permanent record of the treatment of each lot of goods.

The cycle of operations is as follows: The treatment chamber is loaded with the product to be fumigated, care being taken to fill it well to reduce the surplus air space and to conserve the fumigant. The doors are then closed, and both the chamber and the accumulator are exhausted to approximately 29 inches of mercury. The Guardite gas is next introduced into the accumulator, heated, and permitted to enter the chamber, the desired dosage being measured by the drop in vacuum, as shown on the instrument board. Virtually all air having been withdrawn from the chamber, the gas readily permeates all parts of it and comes into intimate contact with the goods undergoing treatment. Ordinarily, the chamber is maintained at around 20 inches of vacuum during the fumigating period of 2½ hours. After that, all traces of gas are removed by first admitting fresh air through breaker valves and again exhausting the chamber to 29 inches of vacuum, the gas being discharged outside of the building to atmosphere. Next, air is once more admitted to the chamber, the doors are opened, and the contents are taken out. The entire operation normally consumes three hours. The cost generally varies between 1½ and 3½ cents per 100 pounds treated.

The accompanying pictures show how imported Turkish tobaccos are fumigated by the Guardite process at the warehouses of the American Tobacco Company at Durham, N. C. Each of the two treatment chambers is designed to accommodate loaded trucks of baled tobacco with a minimum of clearance, so as to reduce the gas requirement. To speed up the work, two accumulators are provided. The gas is heated to 120°F. before being directed into the chamber. In this instance, the fumigating time is from three to four hours. As is customary where operations are not on a 24-hour basis, the last charge of the day is usually permitted to stand overnight, the charge of gas being lessened in proportion to the duration of the treatment. This plant operates under bond: the tobaccos, being dutiable, are handled under Government supervision at all times.

FUMIGATING CHOICE TURKISH TOBACCO

A view along the side of one of the treatment chambers at the American Tobacco Company's warehouses at Durham, N. C., showing the principal operating features of the Guardite fumigating system. At the right is a size 22x9 Class ES-2 vacuum pump which exhausts the air from the chamber prior to the introduction of the gas. In the foreground are cylinders of gas, connected for use. The gas goes first to the accumulator on top of the treatment chamber for heating, and is then admitted into the compartment below. There it is allowed to remain from three to four hours, after which the tobacco is air washed and removed. The instrument board indicates the conditions in the chamber at all times, and a permanent record is kept of the treatment of each lot.



New Portable Compressor for Track Work

A PORTABLE tie-tamper compressor of the creeper type that is said to have many outstanding advantages has been developed by Ingersoll-Rand Company. It is known as the Crawl-Air Compressor, and travels along the track or right of way under its own power. Being only 42 inches wide it can advance between the rails or on the shoulders of the track, thus eliminating the need of cribs. Neither are long air lines required, as the unit moves along with the work as it progresses. The hose lengths leading to the tools are connected directly to the manifold of the machine and carried along so attached ready for immediate service.

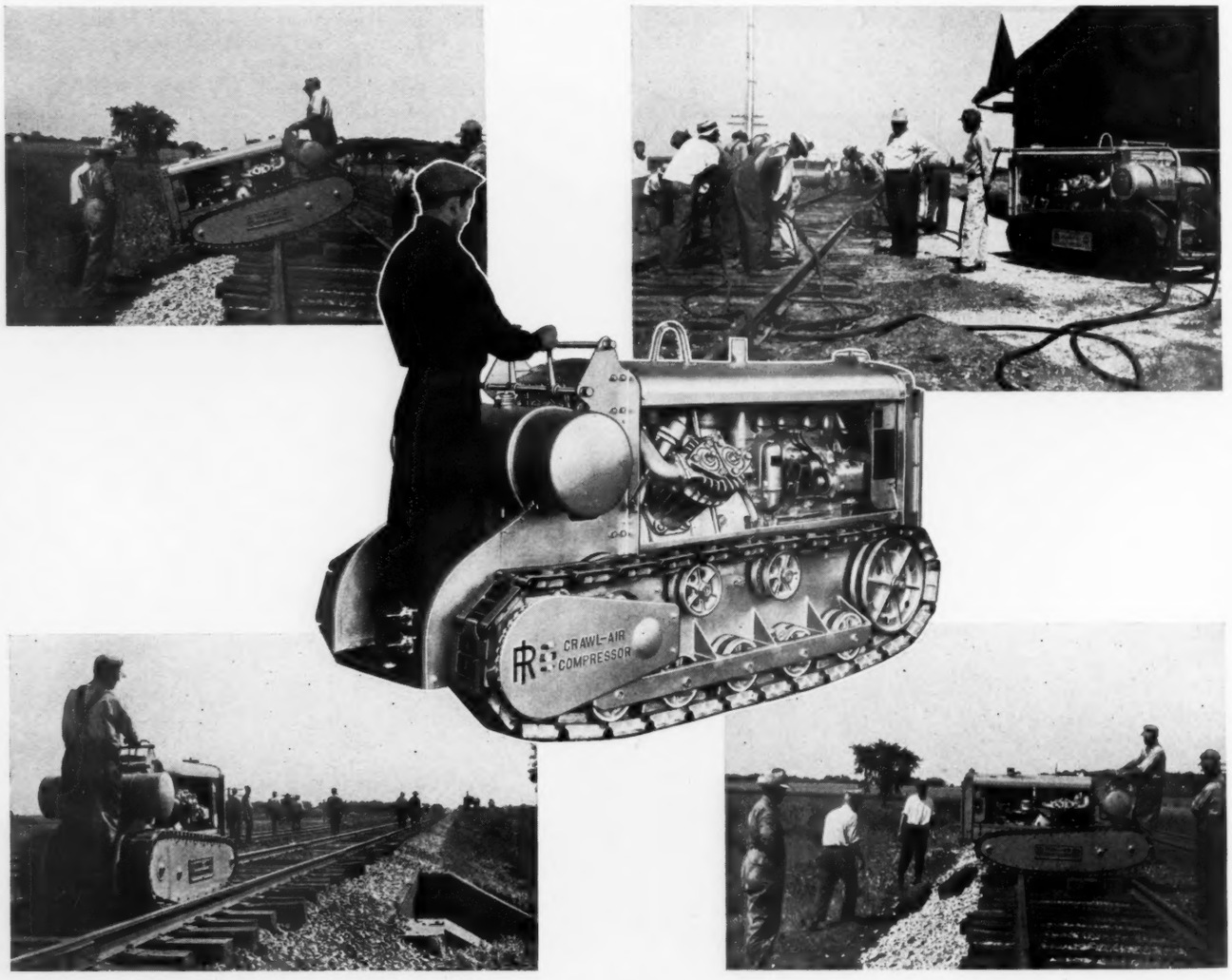
According to the manufacturer, independent air-motor drive on each side of the portable makes for easy and safe control when maneuvering. These air motors permit operating the compressor in either direction or turning it around on its own axis. In addition, they constitute dependable brakes that will prevent the machine from running away on steep grades even when the engine is stopped. It will climb grades up to 40 per cent and, having a low center of gravity, will not tip over at an angle of as much as 45°. Under its own power it can be loaded on to a flat car for long hauls, or on to a hand car for transportation over bridges or through tunnels.

The Crawl-Air Compressor has an overall length of 8 feet 10 inches, is 42 inches wide, 55 inches high, and weighs 5,500 pounds. It can be driven either by a gasoline or an oil engine, the former being of the Waukesha type which, it is claimed, delivers from 20 to 30 per cent more power than other gasoline engines of the same size while operating at higher efficiency and giving a smoother performance.

The unit is equipped with a Model 105 two-stage, air-cooled compressor having an actual air delivery sufficient to operate eight of the company's MT3, low-air-consumption tie tampers. The compressor is a radial-V, 3-cylinder machine and embodies such features as I-R cushioned plate valves and Timken heavy-duty-roller main bearings. Although primarily intended for tie tamping, the portable is suitable for supplying air to rock drills, to track tools in rail laying, and to other pneumatic tools and equipment, including sand blasts, paint sprays, etc., used in bridge and building work generally.

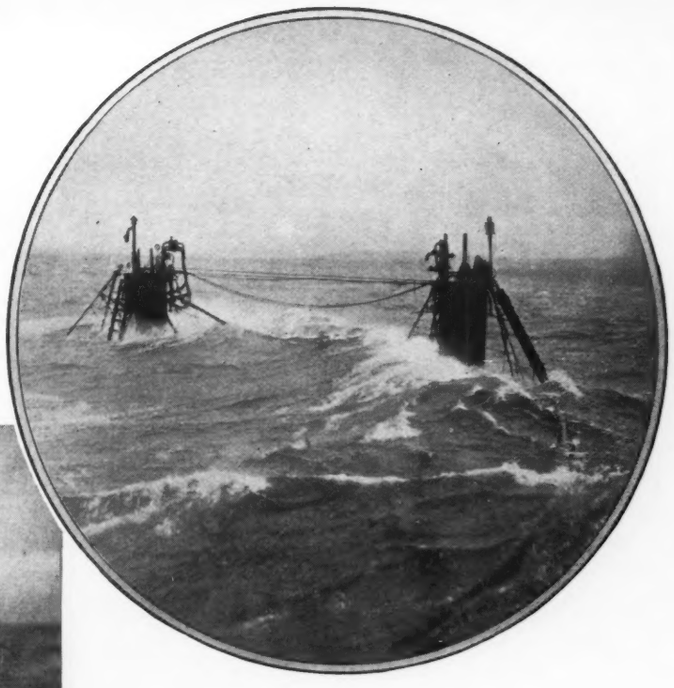
UPS AND DOWNS NO OBSTACLE

The new Crawl-Air portable compressor as it looks at close range and in actual service. At the top right it is stationed on level ground along the right of way supplying air to tie tampers. Where an underpass interferes with its progress alongside the track it can, under its own power, climb up on them, travel between the rails (lower left), and crawl down again in easy stages, as shown in the other two pictures. It is equipped with air motors which enable it to travel forward or backward.



The Salvage of the "Bayern"

T. McKENZIE



AIR LOCKS IN POSITION

The tops of the seven air locks as they appeared after they had been attached to the sunken hull. In the circle are shown Air Locks Nos. 2 and 3 on a rough day.

IT will be remembered that the terms of the World War armistice stipulated that Germany must surrender her fleet. It will be further recollected that a portion of the fleet was interned near Scapa Flow, off the Orkney Islands, in the North Sea, pending a decision as to its disposition. On June 21, 1919, the day before the ships were to have been taken over by the British Admiralty, the German crews, still loyal to their lost cause, by preconcerted action opened the valves and allowed the ships to become flooded. All but two of the more than 30 vessels sank to the bottom.

Subsequently, the British salvage firm of Cox & Danks Limited undertook the gigantic task of raising these ships. Twenty-five 1,000-ton destroyers were brought to the surface with the aid of floating docks. The refloating of the larger vessels required the adoption of other methods, and compressed air came prominently into play. The lifting of the 23,000-ton battle cruiser *Moltke* was described in our January, 1928, issue.

The work which was conducted with fine results by Cox & Danks Limited has now been taken over by Metal Industries Limited, which is, incidentally, the firm which has purchased and will break up the 22-year-old *Mauretania*, for many years queen of the Atlantic. Its first job was the salvage of the 28,000-ton *Bayern*, an accomplishment of the highest order. An account of the manner in which the work was done is here given by the chief salvage officer of Metal Industries Limited, who previously described it in *Shipbuilding and Shipping Record*.

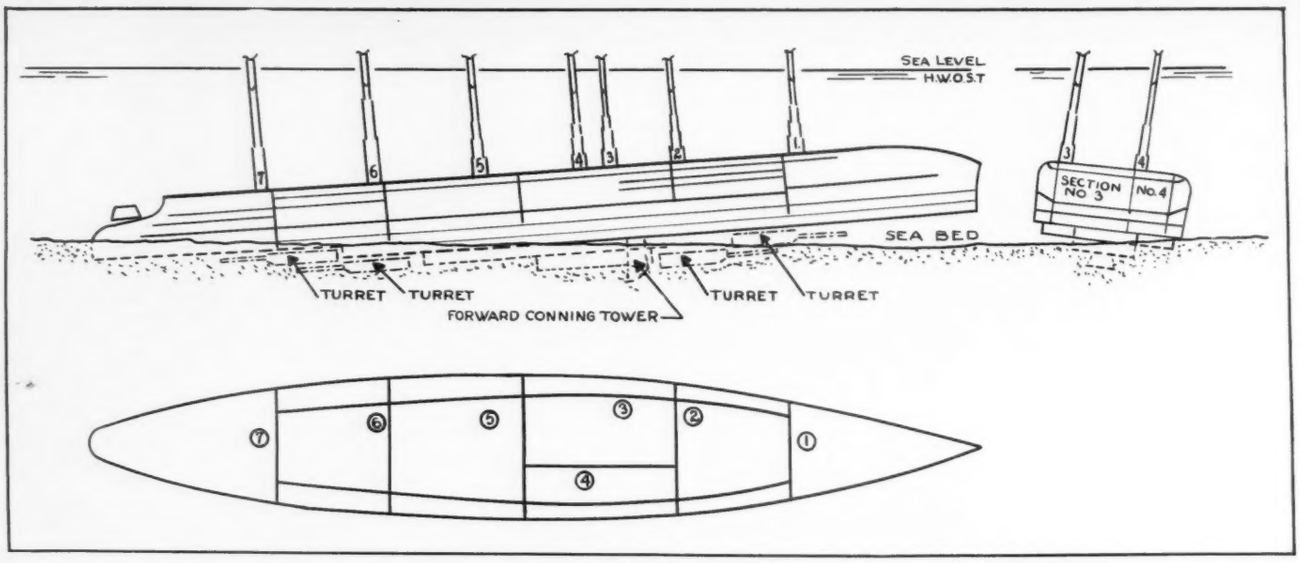
ONE of the most difficult feats of salvage engineering ever attempted was brought to a successful conclusion last September, when Metal Industries Limited, of Glasgow and Rosyth, Scotland, raised the 28,000-ton ex-German battleship *Bayern* from the bottom of Scapa Flow.

Metal Industries Limited took over the salvage depot at Lyness, Orkney Islands, together with the plant owned by Cox & Danks Limited, when that firm abandoned work on the remaining vessels of the sunken German fleet after a splendid record of achievement. Much of the plant acquired, including the floating docks which had played an important part in the salvage scheme previously carried out, was scrapped as obsolete, and the operations were completely reorganized.

A survey was made of several ships, and it was decided to commence work on the *Bayern*. The ship lay bottom up in 20 fathoms of water, with a starboard list of 9°. It was concluded that the only possible method of raising her was with compressed air. As a preparatory step to this end, all bottom valves, ship's-side valves, torpedo tubes, etc., were sealed with special underwater cement by divers.

To provide a working base, the *Bertha* was purchased from the Southern Railway and fitted with powerful compressors, dynamos, workshops, and so on. Five compressors were installed, with a combined output of 2,500 cfm. Included among them were two Ingersoll-Rand Type 10 machines. During the critical stages of the operations, these units ran perfectly night and day for a period of fifteen weeks, and in that time there was not a single involuntary stop. At the conclusion of the work on the *Bayern* the compressors, after a routine overhaul, were transferred with the parent ship to assist in the salvage of another battleship, the *König Albert*, where they are continuing to give the same trouble-free service.

The depth of water over the wreck of the *Bayern* at ordinary spring tides was 65 feet forward and 85 feet aft. This meant that air locks, ranging from 70 to 90 feet in length, had to be fitted to the bottom of the vessel before it was possible to get inside the hull. The design of these air locks is interesting. They were built up in 10-foot sections. The base or lowermost section was 7 feet in diameter, the next two above it 6 and 5 feet, respectively, and the



SCHEME OF OPERATIONS

The two upper sketches show the original position of the "Bayern" as she lay upside down in 20 fathoms of water and with a starboard list of 9°. In order to expel sufficient water to float her, seven air locks were fitted to the hull in the positions indicated. To control the lifting action, the hull was divided into as many sections by bulkheads, as shown in the lower drawing.

remaining sections 4 feet. All air locks were assembled and tested under 90 pounds per square inch pressure at the salvage base at Lyness. Their weight varied from 15 to 20 tons each, according to length.

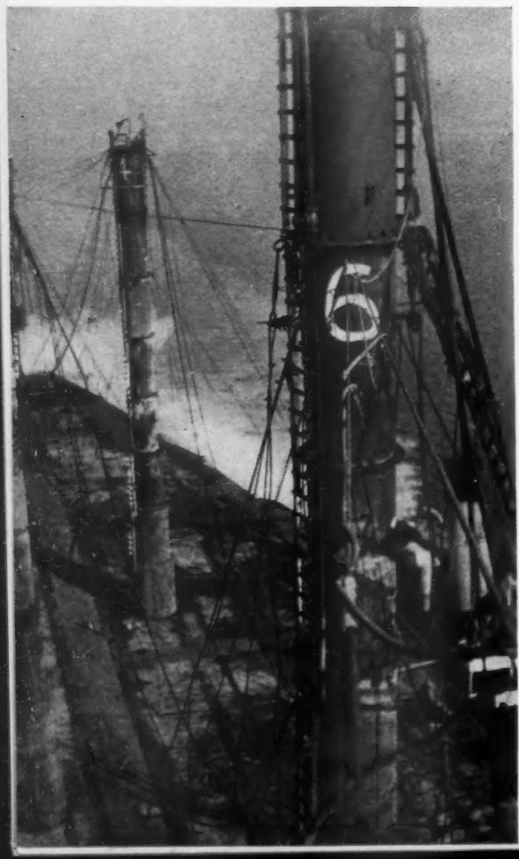
The necessary charging pipes, exhaust pipes, etc., for the compressed air were fitted on all the locks, and all connections were made standard and therefore interchangeable. Resting platforms were provided every 20 feet, and ladders were placed both inside and outside the air locks on the port as well as on the starboard side so that a climbable ladderway would be available at all times irrespective of whatever list the ship might take.

All air locks were taken out to the scene of operations in one piece in order to reduce diving work in deep water to a minimum. Nevertheless, the securing of each lock to the wreck involved a considerable amount of strenuous labor on the part of the divers. Twenty to 24 cleats or eye plates had to be bolted to the hull at fixed points to serve as guy fastenings. Where the air locks were to be attached, a circle of temporary holes had to be drilled with the aid of a template to assure accurate placing. All holes had to be tapped, and plate washers studded into them for taking the bottom flange of the air lock.

Immediately after an air lock was lowered, two divers commenced clamping down the lower flange with the plate washers. Other divers passed up the ends of the wire guys to the men on top of the air lock, who set them bartight with stretching screws as quickly as practicable. The divers then drilled permanent holes through the ship's bottom, using the lower flange as a template, and thus the whole air lock was secured firmly in the shortest possible time. With these preparations completed, the water inside the air lock and working chamber was expelled by air pressure, and a manhole drilled through the hull of the wreck. A similar manhole was next drilled through the tank top. The presence of combustible gases inside the *Bayern* made the use of oxy-acetylene cutters out of the question. Compressed air was then forced into the interior of the ship and the contained water gradually expelled.

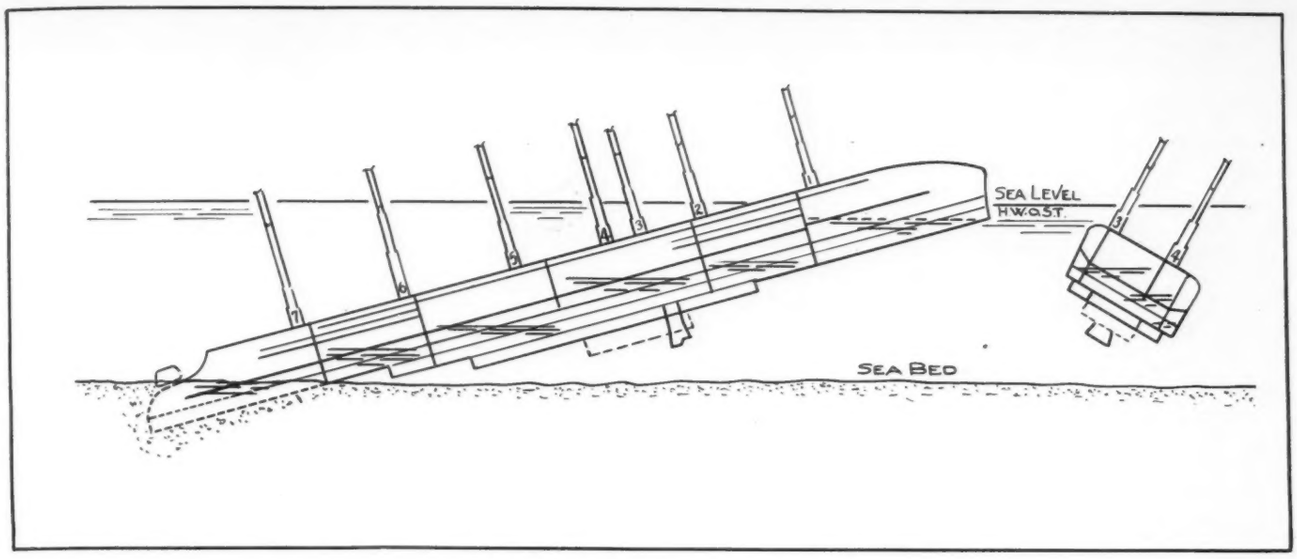
It was necessary to divide the ship into seven sections in order to retain trim and stability when positive buoyancy was established. One of the accompanying drawings shows the subdivisioning provided for in the original scheme. The work entailed in making the bulkheads airtight was enormous. Hundreds of pipes of different sizes had to be cut and blanked, and ventilator casings ranging in size from a few inches to several feet had to be cut away by hand and the apertures in the bulkheads closed. Valves of varying sizes had to be dismantled to deal with leakage; doors had to be strongbacked; and a hundred and one other jobs carried out before any bulkhead could be made airtight. All this had to be done by men working under pressures ranging from 40 to 55 pounds per square inch. All transverse bulkheads had to be reclaimed down to the battery-deck level; and the men doing this toiled much of the time in wading clothes, often in water almost up to their necks. The quality of the air was not always all that could be desired. Decayed vegetable matter generated gases; microscopic animal life used up the oxygen in the air; and in the later stages of the work it often became necessary to exhaust one or more sections to atmospheric pressure in order to get rid of foul air. A chemist was employed to take samples and to analyze the air in all sections periodically, and this precaution was doubtless responsible in large part for the remarkable freedom from accidents throughout the operations.

When work on the bulkheads in all sections had been practically completed to the required level, a singular piece of bad luck occurred. Sections 1, 2, 3, and 4 (see accompanying sketch) had been partly ex-



A MAZE OF TACKLE

A view from the top of No. 7 Air Lock after the "Bayern" was afloat, showing the network of guy wires that had been placed and fastened by divers working from 60 to 80 feet underwater.



THE SITUATION ON JULY 18, 1934

The bursting of a pipe in Section 6 allowed high-pressure air to pass forward into Sections 1 and 2, bringing the bow unexpectedly to the surface. The expansion of the air in the after compartments then caused the stern to rise, so that the ship was afloat. But before the blow-off cocks could be reached, surplus air was exhausted from the stern, making it sink again. The bow was kept afloat by directing the entire compressor discharge into the forward sections. The ship's position was then as indicated here. Her 29½° list to starboard, caused by the shedding of her four turrets, was corrected by depressing the water as shown in the sketch at the right.

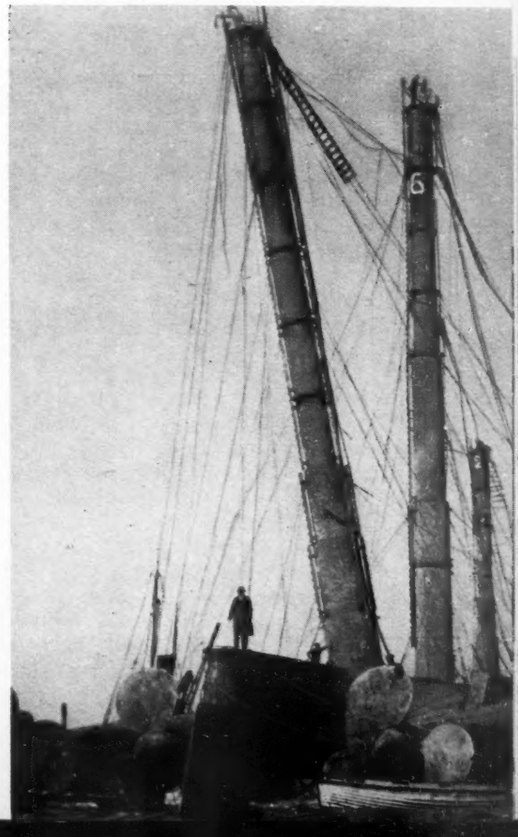
hausted to keep the buoyancy forward negative, and Section 7 aft had been almost entirely exhausted and a safety blow-off left open to keep the buoyancy aft negative. Sections 5 and 6, however, were charged to full pressure. At 7 o'clock on the morning of July 18, a main drainage pipe in Section 6—which had been quite tight previously and was thought to be above suspicion—burst, passed high-pressure air forward to Sections 1 and 2, and caused the buoyancy forward to become positive. To the amazement of the men on duty, the forward air locks commenced to rise, and in less than a minute the bow was 8 to 10 feet above water. The terrific expansion of the air in Sections 3, 4, 5, and 6, induced by the lifting of the fore end, pressed the water right down in those sections, and a few seconds later the stern rose and the ship was completely afloat. The blow-off cocks, however, quickly exhausted the surplus air, which passed through to Section 7, and before the cocks could be reached the ship took a heavy list and the stern submerged. The discharge of the compressors was switched forward and into the starboard compartments, and through the prompt action of the officer in charge the bow was kept afloat. The vessel steadied herself with a starboard list of 29½°. One of the accompanying sketches shows the ship's position after it had come to rest. The situation was somewhat critical.

The cause of the ship's taking such a heavy list was at first obscure, but examinations by divers revealed the rather startling fact that she had shed all four turrets as she left the bottom. The total weight of the turrets was something like 2,500 tons, and this mass, evenly distributed along the center line outside the ship, formed an ideal keel. Calculations showed that the loss of the turrets raised the center of gravity about 28 inches. This gave rise to negative stability under certain conditions and necessitated reclaiming both the transverse and longitudinal bulkheads to a still lower level to obtain positive stability for lifting.

Further calculations showed that while the amount of righting leverage that it was possible to exert by pressing Section 4 to the limit was ample to correct a list of 9°, it was quite inadequate to overcome a list of 29½°. It was therefore decided to seal the starboard-side bunkers down to the battery-deck level to obtain the necessary leverage, and no time was lost in putting this work in hand. One after another the bunkers were reclaimed; and when the last one was nearing the limit the leverage became effective and the list was slowly reduced. The righting lever was decreased as the ship straightened herself, and she was checked when the list was still 5° to starboard. The work of correcting the list occupied fully two weeks. The offending main drainage pipe had meanwhile been blanked.

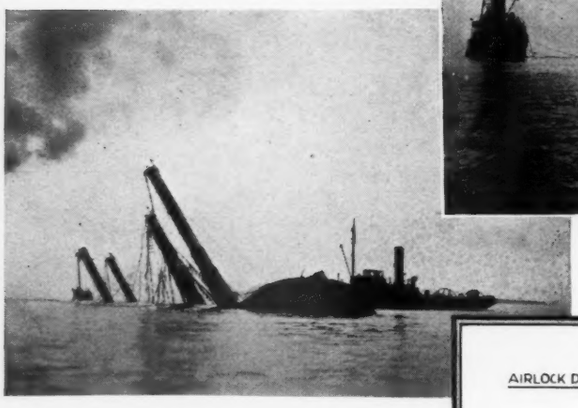
All bulkheads between the various sections were inspected and found to be reasonably airtight. The after compartments were put under a pressure that would force down the water to a safe level, and arrangements were made to raise the stern and to float the ship the following day. Weather conditions turned out to be unfavorable, however, and at 5 o'clock in the afternoon of the day set it was agreed simply to maintain pressures and to postpone lifting operations until the next day. It transpired, though, that the lifting had to be deferred for a much longer period, for at 6 p.m., for no apparent reason, the *Bayern* lurched from her 5° starboard list to about 42° to port and showed a decided tendency to roll right over on her side. To prevent this, the exhaust valves in Sections 1 and 2 were opened and the vessel was allowed to sink to the bottom. As she came to rest, the port list decreased to 22½°.

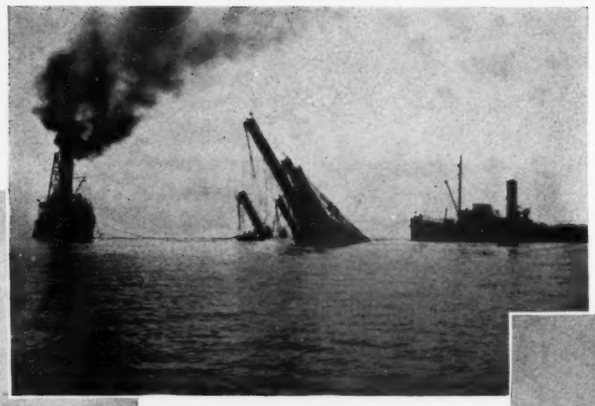
When the ship settled on the bottom, three of the seven air locks were completely submerged and therefore temporarily out



THE BATTLE WON

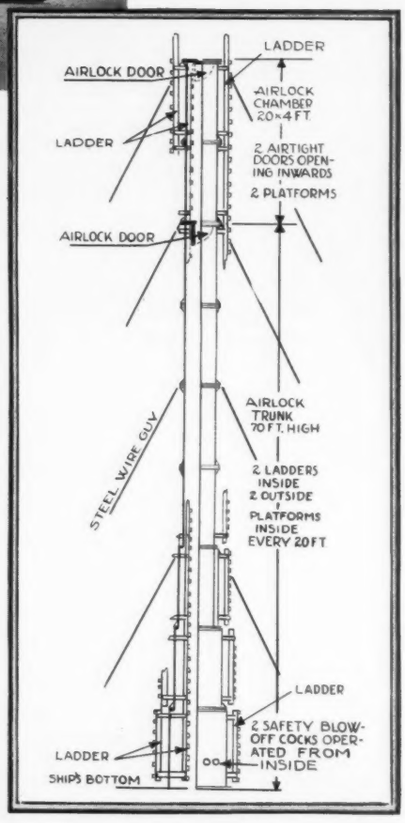
The stern of the "Bayern" after her raising. The great height of the air locks is readily apparent upon contrast with the human figures. A sketch on the following page shows in detail the construction of the locks.





THE BOW COMES UP

Directly above is the "Bavern" as she looked on July 18, 1934. The entire hull had prematurely risen, but the partial escape of the air had allowed all but the bow to sink again. The list was 29½° to starboard. The position of the ship at this time is further illustrated by the sketch on the preceding page. The central view above shows the bow after the starboard list had been lessened to 20°. The ships "Bertha" and "Sidonian," from which the salvage operations were carried on, are in attendance.



CONSTRUCTION OF AIR LOCKS

They were built up in 10-foot sections and ranged from 70 to 90 feet in height. The bottom section was 7 feet in diameter, the next two above 6 and 5 feet, respectively, and the others 4 feet. Ladders were fitted on two sides both inside and out, and interior resting platforms were provided at 20-foot intervals.

BREAKING THE SURFACE

This unusual photograph shows a section of the vessel the instant after she appeared at the surface. She came up with such speed that water 6 feet deep poured off her barnacle-incrusted sides when she was 10 feet above the sea.

of action. The obvious thing to do was to seal the port-side bunkers as had been done previously on the starboard side, and this work was begun with the least possible delay. Extensions were fitted to air locks wherever necessary, and operations were proceeding smoothly again in a very short time. The list was reduced to 14° by pressing the port-side bunkers and at the same time exhausting the starboard-side bunkers as required. It was then decided to raise the bow again, and this was carried out exactly according to program. The list was thus reduced to 3°; and at this point several days were spent in making stability tests. These were concluded on August 31, and showed the stability to be satisfactory.

All compartments were compressed until the buoyancy was just negative; and plans were made to lift on September 1. Pressures were maintained overnight, and at 6 o'clock in the morning all compressors were put on at full power. The lift was timed for 10 a.m., and at 9:45 I gave the "Stand by!" signal. Every man was at his post. Five minutes later the order "Cut pipe lashings!" was given. In two minutes a slight movement of the after air locks was apparent. The stern then freed itself from the bottom and shot to the surface within 30 seconds of the first movement. Huge columns of air and water rose skyward as the surplus air, resulting from the enormous expansion from 50 pounds to 10 pounds pressure, exhausted itself. The great hull broke the surface with such speed that water 6 feet deep rushed down her sides like a miniature Niagara.

Ten minutes after the initial movement, the *Bayern* was flat on the surface with 10 feet freeboard and no list. She was an amazing sight with her barnacle-incrusted hull and the huge 90- and 100-foot air locks towering in the air. The full extent of the operations carried out by the divers became apparent for the first time as the network of air-lock guys stood out against the skyline. The efficiency of the work done by those who had labored for several months under the most arduous conditions inside the ship, at pressures ranging from 40 to 55 pounds per square inch, can be gauged from the fact that no leakage of importance occurred even after terrific strains had been imposed upon bulkheads, patches, etc., by the sudden change in pressure from more than 50 pounds to less than 10 pounds per square inch. Difficulties were often increased by reason of the fact that a great proportion of the work had to be performed while the ship had an acute list. It is no exaggeration to state that at some stages of the salvage the men had literally to slide to their work, and in many instances had to hold on with one hand and work with the other.

On September 2, just 24 hours after she had been raised, the *Bayern* was towed four miles and beached in shallow water less than one mile from the base at Lyness. With the spring tides, a few days later, she was taken to Lyness. There she was prepared for her 260-mile tow to Rosyth to be broken up.

Compressed Air Speeds Exposition Buildings

WILLIAM E. FRAZER

ON MAY 29, in San Diego, Calif., the California Pacific International Exposition threw open its doors in celebration of 400 years of achievement since the day Juan Rodriguez Cabrillo sailed into what is now San Diego Harbor. Not only is the progress of the past receiving tribute but the Pacific West is also welcoming the new era of development and expansion promised by such huge western projects as the $165,000,000 Boulder Dam, the $220,000,000 Metropolitan Aqueduct, the $9,000,000 Los Angeles, Long Beach and San Diego harbor improvements, the $226,000,000 bridges across San Francisco Bay, and, farther north, more than $100,000,000 worth of development on the Columbia River.

The creation of such a display is an enormous task, even though the site and some of the buildings are the same as those that were used during the 1915 exposition which was held to celebrate the completion of the Panama Canal. The present event is on a grander, more extensive scale; and, as a consequence, a score of new buildings had to be designed, constructed, and prepared for occupancy. Grounds had to be altered to harmonize with additional structures, new building locations carefully selected and correlated with the old, and the old buildings rehabilitated and refurnished.

The vast amount of work which all this has involved would, under ordinary circumstances, have consumed many months. But owing to the fact that the final decision to hold the exposition in 1935 was not made until mid-August, 1934, and financing was not concluded until October 1, the preparation time was very limited. As a result, buildings were erected in days that ordinarily would have taken weeks, and in weeks where months would normally have been required. This called for a coördination of effort that can be accomplished only if men and machinery function to a degree approaching perfection. Each phase of every new construction, rehabilitation, and landscape-remodeling project was placed upon a definite time schedule, and each division of the construction forces—from excavators to roofers and interior decorators—had a completion dead line to meet on every job.

It was in the performance of the most difficult of these tasks that compressed air played a leading *rôle* in maintaining schedules. In fully 75 per cent of the various undertakings, excavating and leveling were the most serious sources of delay to the contractors because of the nature of the soil—a hard, rock-like adobe which defied the usual earth-working equipment such as scarifiers, fresnoes, draglines, and shovels. These implements could be used only after the ground had been thoroughly broken by blasting.

The most troublesome and most hurried of these jobs was the removal of some 15,000 cubic yards of earth to level an area of 300x1,000 feet for the Fun Zone. This particular site contained the hardest and the most difficult-to-work adobe in the entire plot. Not only did it have an exceptionally tough crust but it was honeycombed with soft, gummy pockets which caused a great many stuck drills. With such time-thieving obstructions to be overcome, it was of paramount importance that failures of equipment be held to a minimum. Building contractors were scheduled to move in to lay foundations exactly 44 work days from the date excavating was started, and they could not suffer any delays because they had their own dead lines to meet.

Two Ingersoll-Rand portable air compressors, which had been shunted from excavation to excavation, were put on this fastest-paced drilling job of the entire project. One was of 110-cfm. capacity and operated one "Jackhamer" drill: the other was a 250-cfm. machine which ran two drills. Drilling was done with side-hole 4-point "Jackbits." These two compressors were operated steadily sixteen hours a day for 44 consecutive work days. The only shutdown during the daily working period was at the end of the first 8-hour shift, when the machines were serviced.

The blasting crew followed hard on the heels of the drillers. As soon as a set of eight to twelve holes, usually spaced on 6-foot centers in rows 3 feet apart, were drilled and loaded, they were fired. A gas shovel then loaded the broken material into six dump trucks. Drilling time ranged from eight to twenty minutes per hole—about half of the holes being carried to a depth of 6 feet with three changes of steels. In drilling the deeper holes, steels often had to be pulled and "Jackbits" cleaned of the gummy accumulation, or changed. Approximately 7,000 holes were drilled. Ground was broken on schedule with the aid of these same compressors for the Spanish Village, the House of Pacific Relations, the 4,000-seat open-air amphitheater, the Palace of Travel and Transportation, the Palace of Education, the Palace of Women, the formal gardens for the House of Hospitality, the Standard Oil Building, the Ford Motor Building, and a host of smaller attractions.

The site of California's 1935 exposition is Balboa Park—1,400 acres of natural and artificial beauty situated in the heart of

AVENUE OF THE PALACES

A view along the main street of the exposition grounds in Balboa Park. The tall building is the California Tower, dominant structure of the exposition. From the upper part of its 200-foot-high jeweled and mosaic tower the coast line is visible for many miles. The neatly trimmed acacia bushes seen here extend the length of the Avenue of the Palaces.

SITE OF FUN ZONE

Drillers are shown here breaking the tough adobe ground to facilitate leveling the area where the Fun Zone has been created. Record progress was made in this excavation work. The lower picture on this page is an artist's visualization of the same area as it now appears. In it are the most modern thrill-giving devices, as well as displays of a bizarre and unusual nature.

San Diego. Most of the present buildings, the landscaping, and the Cabrillo Bridge, which constitutes the western approach to the grounds, were constructed for the 1915 exposition. The shrubbery, vines, and trees of many varieties, young then, are now matured and firmly rooted, and form a beautiful garden rich in many colors.

The more than 50 display palaces of the exposition house in excess of $10,000,000 worth of commercial exhibits alone, exclusive of the large industrial exhibits for which special permanent buildings have been erected by the exhibitors. Every branch of artistic, scientific, industrial, commercial, educational, historical, and cultural endeavor is represented in well-ordered displays. Bell Telephone, Ford Motor, Standard Oil, and Shell Oil, are among the leading industrial exhibitors.

An experiment in international relations is being made through the medium of the House of Pacific Relations, a group of fifteen complete dwellings in the Spanish style, situated circularly about a large central court. There are quartered the official representatives of fifteen foreign nations, each of which has been allotted a National Events Day on which to present folk songs, games, athletic events, and other demonstrations intended to promote a closer union between the countries concerned. In addition, American businessmen are thus given an opportunity to discuss foreign market conditions with available representatives of foreign commercial institutions.

The Zoölogical Garden, while not under the exposition management, is located within the exposition confines. Second in number of specimens to the Bronx Zoo in New York City, the San Diego Zoo is generally considered to surpass any zoo in the world in the matter of facilities for its animals.

A feature of the exposition significant of early California history is a counterpart of a '49 gold camp, which is called Golden Gulch. Situated in a deep twisting gulch, cabins of the erstwhile sourdoughs, constructed from actual timbers of the gold-rush days, duplicate those of that great era of California's past. Old-time mining men there reënact with early-day mining equipment the tasks they performed in the decades gone. The only means of ingress to Golden Gulch is by stage coach or on mule back.

The entire United States Navy is to be concentrated in the San Diego-San Pedro area at some time during the exposition, and on that occasion President Roosevelt is expected to review it. Mass flights of army and navy aircraft also are tentatively scheduled for the summer months.

ENGINEERS TO THE FORE

UNQUESTIONABLY, the status of the engineer is on the rise. Technically trained men are found in high industrial posts much more frequently than formerly. Perhaps this is because they are taught to think through a problem rather than around it—to visualize the solution before they actually put a plan into effect. Before an engineering structure is built, it is accurately and thoroughly laid out on paper. The man who directs its building knows before he starts just what it will look like and what its physical characteristics will be. Accordingly, when the experienced engineer turns executive he is inclined to weigh every situation carefully and to chart his course of action as directly as possible toward the objective. He is fairly certain to be conservative in policy and sound in judgment.

In affirmation of these statements we may cite the fact that every large mining venture in Canada is now managed by an engineer. This has come about not alone because the engineer knows how to solve the technical problems of mining, although that knowledge is naturally a valuable part of his equipment. There always have been engineering staffs available to direct underground work, but in the old days it was considered advisable to have a "businessman" at the head of things. Experience has shown, however, that the direction of a mining enterprise calls for more than business acumen. For one thing, too many businessmen have fallen prey to the temptation of making misleading, though not necessarily untrue, statements to influence the price of securities. The engineer, on the other hand, while probably of no greater inherent honesty, has decided scruples against managing a mine in the newspapers, so to speak. It is a part of his code of ethics always to have two and two add up four, and not five. His training gives him a certain hard-headedness and substantiality that are difficult for predatory interests to circumvent.

CONCERNING STREAMLINING

WE ARE living in an era of streamlining, and there has been so much talk about it that the public has been inclined to overemphasize its effects. Such is the statement of W. J. Davidson, one of the directors of research of the General Motors organization. A streamlined shape is described as one which most easily displaces the medium through which it is moving and then fills in the hole after it most efficiently. It has long been applied to boats and airplanes and is, of course, a characteristic of birds and fishes.

In all these cases streamlining greatly reduces resistance to motion. So far as it applies to motor cars, however, it is said to have had little effect in decreasing the power required for operation. This is so primarily because the demand for quick acceleration and hill-climbing capacity has made it impossible to reduce the size of the engine in order to take advantage of the aerodynamic advances. The chief benefit of streamlining has been an improvement in the appearance of automobiles—to make them conform more nearly to the natural shape that serves as our standard of beauty of line. The only notable mechanical advance has been a slightly higher speed, with some gain in economy at high speeds.

Streamlining of airplanes results in power savings because they move freely through the air. The same is true of boats with respect to water. Automobiles, on the other hand, must roll along on wheels. Also, automobiles are subject to limitations of design that do not apply to the other types of craft mentioned. Streamlining of a motor car is impractical beyond a certain point because it would produce a body that would be unwieldy in traffic and that would require too much parking and garage space.

We are further informed that the shape of a car has no bearing upon the ease of riding in it. The experts say that so far as comfort of the riders is concerned an automobile could just as well be in the form of a box car.

MORE JOBS FOR COLLEGIANS

THE advance that the engineering and construction industries have made during the past year is reflected in the statement by an official of Columbia University regarding the outlook for employment of 1935 graduates. The fields of chemistry, engineering, and geology are offering more jobs to college men than they did in the spring of 1934. Other lines of endeavor, however, are not accelerating their rates of employment.

It has been apparent for some months that there has been growing activity in industries where chemistry plays a large part. The reopening of breweries and distilleries has contributed considerably to this movement. The augmented demand for engineers can be attributed largely to the Government-financed construction programs. These have created jobs for technical men both in the field and in the numerous factories that supply materials and equipment entering into them. The quickening of the market for geologists is traceable to the boom in gold and silver mining and to the return of the oil industry to its search for additional fields.

There is still a great surplus of college-trained men, not only because there are fewer jobs than there used to be but also because the schools are turning out more graduates than they formerly were. In 1920 there were 360,000 students attending universities: in 1935 there are 1,000,000.

In the study conducted by Columbia University it was revealed that most of the increased employment is coming from large concerns. Small businesses are reported to be hiring virtually no college graduates. In recent years a good deal of the slack in business employment has been taken up by the Government's increasing demand for workers, and the proportion of university graduates entering that field of service has been continually growing. The most overcrowded professions were found to be architecture and law, despite the fact that the Government has given employment to a large number of men from their ranks.

This and That

Disposing of Gold-Mine Waste

Probably few industries create as much waste material as does a gold mine. If an ore runs one ounce in gold to the ton and contains no other valuable metals, the mine is concerned solely with the saving of that one ounce. In the end, then, only 1 part in 32,000 is kept, although several stages of elimination are required to discard the other 31,999 parts. During the process of extracting the gold, the mass is actually increased somewhat by the addition of treatment reagents, the extent of the increase depending upon the process used. Besides, water amounting to several times its own volume is added to the ore.

All this unwanted material must be disposed of. In the western part of the United States it was formerly discharged into streams, but the resulting pollution and discoloration led to the passage of laws against it. Most mines now have settling basins into which the mill tailings are run. Several of these are arranged in series, and from the last of them the water flows clear.

In hilly sections the topography favors locating the settling ponds one below another, thereby permitting gravity flow of the material. This is impossible in flat country, where special arrangements must be made for its handling. Notable among such disposal areas is that of the Hollinger Consolidated Gold Mines in Canada. It is situated some two miles from the mill on ground which was bought for the purpose. Eventually, if the ore holds out, a huge pyramid, measuring a mile by half a mile at the base, will be formed there. Already it is 94 feet high and contains 12,000,000 tons of crushed material, all of which has been deposited in ten years. Each day there is added to the mass about 4,080 cubic yards. In solid form this represents the rock removed from a tunnel 6x6 feet in section and 2,000 feet long.

The tailings are conveyed to and distributed over the mound by wooden pipes, the discharge from which is regulated so as to build up the pyramid evenly. The aim is to control the flow so that the coarse, porous materials will remain near the outer edges and the fines will be carried inward. This insures keeping the vast pile intact and also permits a large amount of the water to filter through the sides and to escape. That which collects in the center is drawn off into settling basins.

The formation of rivulets which would run down the sides is carefully guarded against, as these would cut channels and eventually miniature canyons. From time to time the sides are raked to assure an even run-off of rain water. Retaining dikes are built up around the outside edges in 9-foot lifts by a power shovel which takes its material from about 20 feet within the mass. This trench is filled with fresh tailings. The resultant water is clear and virtually free from cyanide and other chemicals used in the treatment process.

* * *

Air Curtains Replace Doors

On the newest of the Burlington streamlined trains there is no door between the kitchen and the eating compartment of the dining car, yet the odors and heat from there do not enter the space where passengers are served. They are swept out of the car and exhausted to atmosphere by a curtain of moving air. The air is forced through slits at either side of the door frame, being directed at a slight angle toward the kitchen. The two sheets of air meet in a vertical line midway between the door frame and are then sucked upward by an exhaust ventilator placed overhead and on the kitchen side of the opening. Air for the forced draft is supplied by the compressor which is a part of the air-conditioning equipment of the car. In addition to improving the atmosphere within the car, the air curtain makes it unnecessary for waiters to open a door on their way to and from the kitchen and enables them to see when someone is approaching from the opposite side. Air curtains of this sort are also being used in industries for removing fumes from around paint-spray booths and serve in place of solid doors on drying ovens.

* * *

New Diving Ball

There is scheduled for demonstration in Washington this month a commercial diving ball similar to the Barton bathysphere which has been used by Dr. William Beebe in his scientific studies of subaqueous life in Bermuda waters. The ball has been developed by the Romano Salvage Corporation of Seattle, Wash., and will, it is claimed, revolutionize methods of deep-sea salvage. The sphere is built of steel, strong enough to withstand the water pressure 2,500 feet beneath the surface, and is equipped with a number of projecting arms that can be operated from within. These mechanical hands can be so closely controlled that they can be made to tie knots in cables, operate boring tools, and perform the most delicate and intricate tasks. It is believed that the new sphere can be employed to attach cables to a sunken vessel to permit the lowering of tanks, which can then be made fast to the wreck, pumped out with compressed air, and used to lift the ship to the surface. The harvesting of sponges is seen as another of its possible commercial applications. The sphere is equipped to supply pure air for a continuous working period of twelve hours.

Building Dams His Specialty

If practice makes perfect, as the old adage assures us, Ross White should by now have attained the status of a paragon among dam builders. Save for a 3-year apprenticeship as assistant engineer of Manila, P. I., Mr. White has been building dams ever since he left Iowa State College. He already has eight to his credit, and with the completion of Norris Dam he will have marked up number nine.

Mention of Mr. White is prompted by the news of his recent merited promotion to general superintendent of construction for the Tennessee Valley Authority. In his new position he will have charge of work at Norris, Wheeler, Pickwick, and at any other dams which the TVA may elect to rear.

Ross White started on his career of dam building when he became construction engineer for the Turlock Irrigation Company in California upon his return from Manila. The San Joaquin Valley was the scene of his first effort. From there he shifted his endeavors to the Merced River in California. After building one dam there, he put up three concrete barriers in the high Sierras for the Feather River Power Company. The Aluminum Company of America then engaged him to build a dam on the Saguenay River, 300 miles north of Toronto. Having observed his talents, the Province of Ontario prevailed upon him to remain in Canada long enough to construct a dam on the Abitibi River. With this done, Mr. White returned to California to take charge of the erection of the Pine Canyon Dam for the City of Pasadena. His next move was to the Tennessee Valley as construction superintendent at Norris Dam. That structure is now ahead of schedule, and its cost is running well below the Government estimates.

Taking Mr. White's place at Norris Dam is F. C. Schlemmer, who has ably served there as assistant construction superintendent since the work began. Mr. Schlemmer has had a busy life directing the construction of power plants, industrial developments, and building projects in various parts of the United States and Canada. After helping to put up a large oil refinery at Parco, Wyo., from 1922 to 1924, he went to New York City for two years as assistant to the construction engineer in charge of the electrification of the Staten Island Railroad Company. He was then, successively, construction superintendent for power-house projects at Inglis, Fla., Tallahassee, Fla., and Bremo Bluff, Va. In July, 1933, he joined the TVA personnel as manager of the Muscle Shoals power plants in Alabama, and in November of the same year he went to Norris Dam as assistant to Mr. White.

Industrial Notes

Technical Products Company, Pittsburgh, Pa., has produced a water- and acid-proof cement that is said to harden into a porcelainlike material within 36 hours. It can be used like ordinary portland cement.

Research in Russia's Glass Institute has resulted in a so-called stone glass that has been produced in 64 different colors. It is offered as a substitute for marble as a facing for buildings, etc., and is reported to be stronger than that material and more resistant to frost and acid attack.

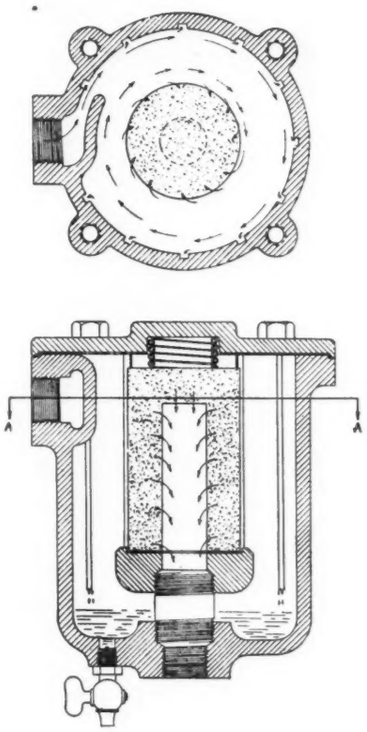
According to plans recently approved by the U. S. Secretary of the Interior, the height of the Hetch Hetchy Dam, which impounds water for the San Francisco area, is to be raised from 344.5 feet to 429.5 feet. The additional 85 feet will increase its storage capacity 69 per cent.

A plastic compound has been produced for use instead of putty in glazing windows, skylights, etc., that are subjected to vibration. The material is composed of a variety of treated oils and pigments and is said to be unaffected by moisture and to remain plastic for a long time. It is known as Plastoid No. 18, and can be applied to either wood or steel sashes.

Recent news reports from Russia have it that a plant is being built there for the manufacture of gas from coal lying in its original position underground. The gas is to be used for firing steam boilers above ground. Just how this is being done is not divulged; but the experiments that led up to the present large-scale operations of carbonizing coal in the mine are described in *Fuel*, published in London.

Spiral leather packing that comes by the 100 feet for cutting up as it may be needed is a new product of the C. W. Marsh Company, Muskegon, Mich. It is available at present in ½-inch and ¾-inch standard widths, and the coils are made in five diameters between 6 and 16 inches. These can be wound on rams of any size between these diameters, as well as on larger ones. Rings of any desired length can be cut from the coils for insertion in a packing box in the usual staggered fashion. The material used for this packing is the company's Thermo leather that is said to swell or shrink but little. Because of its spiral form it is not necessary to construct special tools to produce either U or V rings.

Something new in a combined air filter and separator has been put on the market by R. P. Adams Company, Buffalo, N. Y. Its filtering element is made of aluminum oxide crystals and a ceramic bonding material and is in the form of a tube that has been vitrified at a temperature of 2,372°F. It is said to have a porosity equal to 38 per cent of its total material volume. The air is introduced into the filter proper through an orifice in the upper rim of the metal casing, and throws off and into vertical slots any entrained oil, water, etc., as it circulates rapidly upon entering. Approaching the inner axis of the filter it slows down in velocity and passes through the porous walls of the filtering element, which is open at the lower end to permit the escape of the clean and dry air. After an operating period of from ten days to two weeks, depending upon the condition of the air, a spare is substituted for the filtering tube, which is then cleaned in any oil solvent and thus made ready to take its place again as soon as its duplicate becomes clogged.



AIR FILTER AND SEPARATOR

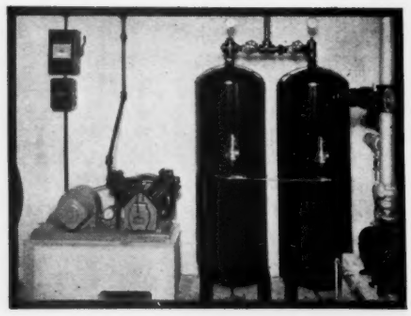
Sectional drawings of the Triumph type air filter showing its structural arrangement and its method of functioning. The cross section is taken at A-A.

The Underwriters' Laboratories have approved a fire extinguisher that is suitable for use wherever compressed air at 100 pounds pressure is available and that is designed for putting out fires starting around electrical equipment, inflammable liquids, and combustibles generally. It is a 2-quart unit consisting of two concentric, seamless-copper cylinders mounted in top and bottom castings. The inner cylinder contains compressed air, and the space between it and the outer cylinder wall is filled with Pyrene. Normally, the liquid is not under pressure, a shut-off valve at the top of the extinguisher controlling the flow of the air which forces it out through the discharge nozzle. This delivers a fan spray when it is partly open and a solid stream when fully open. The unit is 18 inches high, 5 inches in diameter, and weighs 16½ pounds when ready for service. It can be recharged with both air and Pyrene when these are exhausted.

A large industrial plant that uses a good many safety and relief valves on its boilers, process lines, compressors, and air tanks, has recently conceived the idea of tagging them because it was found that no one person could offhand remember certain essential facts in connection with them. To each valve has been firmly affixed a heavy brass tag bearing three numbers: one, its own identifying number, and the two others representing, respectively, its pressure setting and the maximum allowable pressure of the unit which it is designed to protect. These, together with the location of each valve and the date at which it was set at the given pressure, are recorded in a notebook that is kept by the chief engineer. With this system of identification, it is now necessary only to glance at the tag on a safety valve and to test its popping pressure—which should be done periodically—in order to determine if the valve setting has been tampered with and how much leeway there is for a possible increase in pressure.

Centrifugal force serves many useful purposes, and one of the newest of these is to transform molten glass into a woolly fibrous substance that is finding increasing application industrially. The process is the invention of a Swedish engineer. By it, the fluid glass is made to run down upon a disk that rotates at high speed, the centrifugal force causing the mass to separate and to form extremely fine fibers. A current of air blown downward and around the edge of the disk carries the product on to conveyors for cutting and other finishing operations. The fineness of the threads can be controlled within certain limits by regulating the temperature of the molten glass and the quantity fed upon the disk in a given period. Glass wool is now used variously as a filtering medium for liquids, compressed air, etc., for scrubbing gas, in the manufacture of textiles, and as an insulating material. It is very fluffy, as can be realized from the fact that an insulating mat, made by pressing and sewing the material, contains only about 4 per cent of glass by volume.

BIG and little ones



have this one thing in common

ALL COMPRESSORS lose efficiency, entail excessive maintenance and repair expense, develop fire and explosion hazards, if the lubricants used are not specifically right for their particular service conditions.

It's easy and inexpensive to avoid such hazards. Among the lubricants Texaco recommends for air compressors, there is one that is specifically right for your units. In addition, Texaco places at your disposal a technical service to help your operators. This aids them to select oils that will meet your requirements efficiently — economically.

For every type of unit

NO MATTER WHAT TYPE OF UNIT you operate, Texaco *tested* Lubricants are dependable and efficient.

In mining operations, on construction jobs, in the newest type of vertical units and small portable compressors, Texaco Cetus, Texaco Alcaid, Texaco Algol, Texaco Ursa for air compressors are protecting against mechanical failures and time out of service for cleaning.

More Lubrication for your dollars

TEXACO TESTED LUBRICANTS are preferred by air compressor operators because *they cost less to use.* You can feed them in very small quantities. Their exceptional freedom from carbon-depositing elements helps them to lower maintenance costs.

A representative of The Texas Company can show you convincing proofs of these benefits. And the way in which Texaco cooperates with your men helps them to devise valuable economies — important operating efficiencies.

THE TEXAS COMPANY
135 East 42nd Street New York City

Nation-wide distribution facilities assure prompt delivery

TEXACO *tested*

REFINERY TESTED FOR UNIFORMITY . .